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ABSTRACT

The Calculators and Mathematics Project, Los Angeles (CAMP-LA), funded by the National Science Foundation for developing use of technology in the classroom, developed curriculum materials focused solely on the use of calculators. The project was developed in three stages. The first stage studied the mathematics curriculums from different states and identified topics that are not included but should be if every student had a calculator, topics treated in too much detail, and topics no longer appropriate. Based on this information, CAMP-LA compiled a prototype curriculum organized by grade level to be consistent with the "California Mathematic Framework" strands. The second stage developed lessons to cover the topics through the curriculum. The third stage field tested these lessons in various parts of the country. This book is composed of lessons for grades 5-6 in the series. The introduction gives an overview of CAMP-LA, information on how to use the lesson plans, a discussion of assessment approaches, and a scope and sequence for the book. The remainder of the book is composed of 43 lessons in four chapters: Patterns and Functions, Logic/Statistics and Probability, Measurement/Geometry, and Number/Algebra. Each lesson is broken down into three sections. The three sections are labeled: "Grade", including grade level, strand, skill required, and purpose; "Management", including class organization, time frame, materials needed, vocabulary, and prerequisite skills; and "Lesson" including suggestions for directed instruction, guided practice, independent practice, evaluation, and home activity. (MDH)

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CAMP - LA

BOOK 3 GRADES 5 - 6

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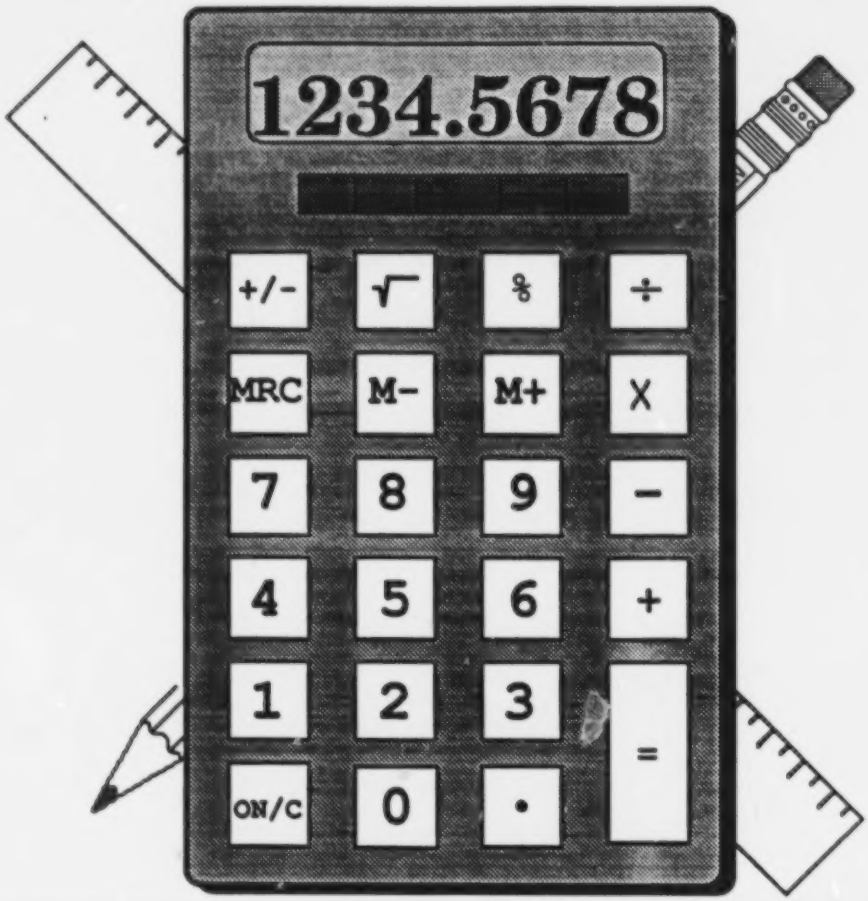

BOOK 3
GRADES 5 - 6

GEO52577

**Calculators and Mathematics Project,
Los Angeles (CAMP - LA)**

David Pagni, Editor
Cal State Fullerton Press

CAMP-LA
BOOK 3
GRADES 5 - 6

CAMP-LA PROJECT STAFF

Co-director ..... David Pagni

Co-director ..... Robert Hamada

K - 2 Writing Team ..... Marea Channel
..... Vicki Newman

3 - 4 Writing Team ..... Jan Christinson
..... William Hammond
..... Shirley Roberts
..... Bruce Takashima

5 - 6 / 7 - 8 Writing Team ..... Zelda Gold
..... Elisabeth Javor
..... Steve Rosentsweig

K - 2 Spanish Translation ..... Fred Chavez

Production Typist and
Computer Graphics ..... Donald Luey

Cal State Fullerton Press

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The following mathematics lessons were produced by the Calculators and Mathematics Project, Los Angeles (CAMP-LA). The project was supported by California State University, Fullerton, Los Angeles Unified School District and the National Science Foundation (Grant #MDR - 8651616). However, the opinions, findings, conclusions or recommendations expressed herein are those of the authors and do not necessarily reflect the views of the National Science Foundation. The lessons were developed around mathematics topics that could be taught or enhanced with the use of a calculator. In some cases the calculator is used to explore or learn a mathematical concept; in other cases, it is used as a computing tool. All lessons were field-tested in the Los Angeles Unified School District in a wide variety of school settings. Sample lessons have been used in workshops for teachers and other mathematics educators across the United States. The CAMP-LA lessons have always been well-received. The directors and writers of CAMP-LA believe that you and your students will find these lessons to be fun and challenging!

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Advisory Board: Art Hiatt, California State University, Fresno
Robert Reys, University of Missouri
Walter Szetela, University of British Columbia
Marilyn Suydam, Ohio State University
J. Fred Weaver, University of Wisconsin (Retired)

Field Testers:

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Henry Behrens
Renee Boswell
Desdra Butler
Marjorie Champawat
Joan Douglas
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Cheryl Eppink
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Lynn Tharsing
Mary Lou Vanderlip
Merrie Wartik
Audrey Washington
Diane Weinstein
Kimi N. Yasui

Consultants:

Karen Bachofer
Adriana Brady
Becky Breedlove
Marjorie Cochran
Dennis Dulyea
Ed Esty
Viggo Hansen
Claire Heidema
Chris Holle
Pat Johnson
Donna Jorgensen
Judith Koenig
Beatrice La Pisto
Kolburn Hughes
Patti McCullough
Terri Pagni
Karen Richey
Carolina Tercero

Books by David Pagni:

CAMP- LA Book 1

CAMP- LA Book 2

CAMP- LA Book 3

CAMP- LA Book 4

Math Lessons for Grades K - 3

Math Lessons for Grades 3 - 5

Math Investigations for the Months

PROJECT BACKGROUND

The Calculators and Mathematics Project, Los Angeles (CAMP-LA) was one of six projects[1] in the country funded by the National Science Foundation, Division of Materials Development and Research Instructional Materials Development Program, under a special program solicitation entitled "Materials for Elementary School Mathematics Instruction" in September, 1986. The special solicitation requested proposals that focused on the use of technology in elementary school mathematics.

Of these six projects, only CAMP-LA focussed its efforts soley on the use of calculators. The CAMP-LA philosophy is that every child should have access to a calculator at all times when investigating, studying, or learning mathematics.

The lesson development process spanned three stages. First, the project teams of writers and the two co-directors studied the mathematics curriculum guides from different states. They looked for:

- Topics not treated but which should be (assuming every child has a calculator)
- Topics treated in too much detail
- Topics no longer appropriate

Based on the results of this research, the CAMP-LA staff compiled a prototype curriculum organized around the strands of the *California Mathematic Framework*: Number, Measurement, Geometry, Patterns and Functions, Statistics and Probability, Logic, and Algebra. The CAMP-LA staff next isolated those topics that lent themselves to being taught with the use of a calculator. These topics were organized by grade level and became the CAMP-LA Calculator Continuum.

The second stage of the lesson development process was the writing of lessons that captured the essence of the Calculator Continuum. At this time, we decided to introduce a new strand, the Calculator Awareness strand for lessons designed to introduce students to the mechanics of operating a calculator. Of course, these lessons for introducing the calculator features are written in a mathematics context.

Drafts of lessons were written during the summer, 1987. During the following fall these skeletal lessons were evaluated to see which ones needed to be fleshed out, which needed to be deleted, and where in the Calculator Continuum additional lessons were needed.

The third stage of the CAMP-LA lesson development process was the field testing of the lessons. Because of a nationwide interest in the project, a few lessons were field tested in schools in various parts of the country. However, all lessons were field tested in the Los Angeles Unified School District in a variety of school settings. The CAMP-LA field test teachers turned in written reports including samples of students' work for each lesson. The field test teachers also met with the project writers to discuss the strengths and weaknesses of the various lessons. The field testing went hand - in - hand with new lesson development throughout 1988, 1989, and 1990. During the summer and fall of 1990 the writing teams completed their work and the final editing was completed by David Pagni, Principal Investigator and Co-director of CAMP-LA.

CAMP-LA Books

Book	Grade Level	Cost
Book 1	K – 2	$14.95
Book 2	3 – 4	$14.95
Book 3	5 – 6	$14.95
Book 4	7 – 8	$20.95

[1]The six NSF funded projects were:

1) "A Revision of the Geometry and Measurement Strands, K-6" University of Georgia

2) "Calculators and Mathematics Project, Los Angeles"
California State University, Fullerton

3) "Development of a Logo–Based Geometry Curriculum"
Kent State University

4) "K–6 Supplementary Mathematics Materials for a Technological Society"
New York University

5) "Reckoning with Mathematics: Tools and Challenges for the Information Age"
Education Development Center

6) "Used Numbers: Collecting and Analyzing Real Data"
Technical Education Research Centers

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Scope and Sequence xv

Chapter 1: ***Patterns and Functions***

The study of patterns enables students to see order and predictability in many situations. Students have a powerful tool for solving problems when they understand patterns and functional relationships.

Lesson	Title	Objectives	Page
1	Addition Oddities	Explore number patterns using addition.	1
2	Chessboard and the Wheat	Investigate growth of powers of 2. The lesson is based upon a famous mathematical story.	5
3	Strange Sequences	Investigate sums of consecutive odd numbers.	12
4	An Ancient Oddity	Discover patterns on an ancient stone tablet.	15
5	Palatable Patterns	Explore the relationship between specific sums and divisibility by 11.	22
6	Follow the Flow Chart 1	Use flow charts to identify, extend and create number patterns. These flow charts each use one operation.	27
7	Follow the Flow Chart 2	Use flow charts to identify, extend and create number patterns. These flow charts each use two operations.	38
	Chapter Assessment		44

Chapter 2: ***Logic/Statistics and Probability***
Logical reasoning develops as students identify attributes, recognize patterns, and use relationships to analyze mathematical situations. Students reason, make conjectures, and draw conclusions as they move from working with concrete materials to abstract thinking. Knowledge of statistics allows students to summarize what they know of the world and to make inferences about what they do not know. The study of probability enables students to indicate how certain they are about a prediction.

Lesson	Title	Objectives	Page
8	Going to the Movies	Explore combinations of different priced movie tickets to organize and interpret data.	47
9	Number Claim	Use 4 digits and various operations to claim numbers on a chart.	52
10	I Love Math	Discover how physical activity affects your heartbeat.	57
11	How Fast Can You Run?	Data generated by physical activity is used to find averages.	62
12	M & M & M	Determine the mean, median and mode from a set of data.	65
13	License to Count	Explore the number of license plate possibilities.	72
14	What's in the Bag?	Experiment by repeated sampling to determine probabilities. Convert fractional probabilities to percents.	78
	Chapter Assessment		85

Chapter 3: ***Measurement/Geometry***
When we measure, we attach a number to a quantity using a unit which is chosen according to the properties of the quantity to be measured. Estimation plays an important role in the manipulation of non-standard and standard systems as well as conversion within and between systems of measurement. The study of geometry enables students to identify, describe, compare, and classify geometric figures. Students develop spatial sense and problem solving skills using geometric models.

Lesson	Title	Objectives	Page
15	Coin Caper	Creatively explore the value of a line of coins. May be integrated with Physical Education.	87
16	How Much Money Will I Have?	Learn about exchange rates and foreign currency values.	91
17	I Have, Who Has	Find perimeters of various polygons. Builds reading and listening skills.	94
18	Whats Your Angle?	Discover the sum of the angle measures in triangles, quadrilaterals, pentagons, hexagons and octagons.	103
19	Its All In How You Look at it	Help students recognize that any of the three sides of a triangle can be thought of as the base when calculating area.	110
20	Circle To The Right	Explore the relationships between the sides of right triangles and discover the Pythagorean Theorem.	120
21	I Search, You Search	Make discoveries while computing the areas of triangles.	125
22	Folding Paper	Fold paper to build an understanding of the area and perimeter of rectangles.	129
23	Easy as Pi	Discover the relationship between the diameter and the circumference of a circle.	133
24	Wheels on the Bike Go Round and Round	Use circumference to make decisions about wheels.	140
25	Which Holds More	Estimate and compute the volume of cylinders.	144

Lesson	Title	Objectives	Page
26	Chris' Up and Down Day	Converts metric and customary units using temperature formulas.	149
	Chapter Assessment		155

Chapter 4: ***Number/Algebra***
Numbers are used to record and interpret information, solve problems, and to make decisions. Students develop number sense by being asked to make a choice among computational methods: estimation, mental arithmetic, paper and pencil, and the calculator. Algebra is studied informally to develop an understanding of abstract relationships. Students learn to express numerical relationships through the use of the variable.

Lesson	Title	Objectives	Page
27	Leftovers	Use a calculator to find remainders when dividing whole numbers. Interpret remainders in division word problems.	161
28	Guinness Eggception Facts	A problem solving lesson based on facts about eggs.	164
29	EZ Millions Trivia Pursuit	Develop number sense and explore the meaning of 1,000,000 in problem situations.	169
30	Get the Point	An introductory lesson to discover the proper placement of decimal points when multiplying decimal numbers.	177
31	Digital Reaction	A discovery lesson on multiplication and division of decimals by 10, 100, 1000.	182
32	What Would You Weight on Mars?	Apply decimal multiplication and division to weights on other planets.	188
33	Butcher Math	Apply decimal multiplication and division to pricing labels.	193
34	Best Buy	Explore unit pricing.	200

Lesson	Title	Objectives	Page
35	Popcorn Ball	A situational lesson that explores the costs and potential profit of making and selling caramel popcorn balls.	203
36	Watch Your Money Grow	Problem solving exploration of powers using money as motivation.	210
37	Your Gain Your Loss	Explore how exercise and foods relate to weight loss and gain.	219
38	Decimal Discovery	Discover number patterns while changing fractions to decimals.	226
39	Mystery Spaces	Complete an equation by determining the missing symbol or digit.	233
40	Pardon My Dear Aunt Sally	Use the order of operations to compute.	238
41	Multiple Madness	Find Least Common Multiples.	244
42	Dubious Discounts	Find the discount and percent of discount.	249
43	Going Camping	Plan a camping trip as a group project.	252
	Chapter Assessment		260

CAMP-LA OVERVIEW

The **Calculators and Mathematics Project, Los Angeles (CAMP-LA)** provides materials for grades K-8 that integrate the calculator into the elementary school mathematics curriculum in a meaningful way.

CAMP-LA lessons support the philosophy expressed by the :

Mathematical Sciences Education Board
- **Everybody Counts**

National Council of Teachers of Mathematics
- **Agenda for Action,**
- **NCTM Standards**

California State Department of Education
- **Mathematics Framework**

CAMP-LA materials were written by classroom teachers and resource specialists. These materials are divided into four levels.

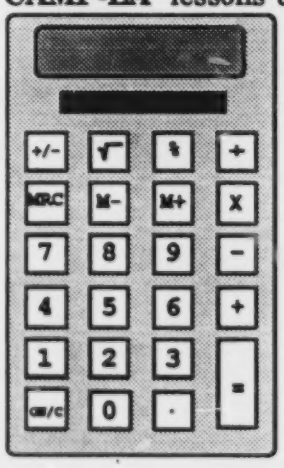
Grades K-2
Grades 3-4
Grades 5-6
Grades 7-8

The fifth and sixth grade lessons are printed in four chapters.

Patterns and Functions
Logic/Statistics and Probability
Measurement/Geometry
Number/Algebra

Meaningful assessment of student understanding is provided for all levels.

CAMP-LA lessons use calculators with the following features:



- Constant function for basic operations
- Clear/ Clear entry key(s)
- Memory Keys
- Square Root Key
- % Key (Recommended but not essential)

FEATURES OF CAMP-LA LESSONS

Calculators and Mathematics Project, Los Angeles Lessons:

- Provide a challenging currriculum based on the assumption that every child has access to a calculator.
- Help students become confident and comfortable using the calculator as an effective tool for exploring mathematical concepts.
- Develop students' ability to choose how and when to use a calculator.
- Assist students to make the connection between the concrete and the abstract.
- Emphasize conceptual development, reasoning, numerical relationships, and application in real-life experiences.
- Help students use the language, symbols, and processes of mathematics to gain confidence with numbers.
- Encourage the discovery of patterns in our number system.
- Remove computational constraints so that students can focus on the processes of solving problems and develop problem-solving skills and strategies.
- Provide students opportunities to reason logically and develop an intellectual curiosity toward mathematics.
- Stimulate interest in mathematics.
- Involve students in cooperative learning groups to solve problems.

CAMP-LA LESSON FORMAT

MANAGEMENT

A **Table of Contents** guides teachers in the selection of lessons. When lessons are integrated throughout the school year, students become familiar with the calculator and feel confident using it as a tool to learn mathematics. **CAMP-LA** lessons recognize that learning is often enhanced when the calculator is used with other learning materials. Lessons are models of how to incorporate calculators into the mathematics curriculum.

CAMP-LA LESSON PLAN FORMAT

All lessons in the **Calculators and Mathematics Project, Los Angeles** follow the same format.

Teacher Information

CAMP-LA	**LESSON TITLE**
GRADE LEVEL:	Indicates appropriate grade levels.
STRAND:	Identifies content strand: Number, Measurement, Geometry, Patterns and Functions, Statistics and Probability, Logic, or Algebra.
SKILL(S):	States the skill developed in the lesson.
MANAGEMENT	
CLASS ORGANIZATION:	Recommends whole class, small groups, or pairs.
TIME FRAME:	Approximates the time needed to present the lesson.
MATERIALS:	Lists the materials necessary to implement the lesson.
VOCABULARY:	Identifies mathematical terms and other vocabulary used in the lesson.
PREREQUISITE SKILLS:	States entry skills needed for successful completion of the lesson.

LESSON

DIRECTED INSTRUCTION:

Lessons are developed sequentially.

Suggestions for delivery of instruction include the use of:

- **Problem Solving**
- **Concrete Materials**
- **Cooperative Learning**
- **Mathematical Language**
- **Situational Lessons**

Questions are provided to:

- Stimulate critical thinking
- Focus on concepts to be developed
- Encourage student involvement

GUIDED PRACTICE: Students are provided practice under the teacher's guidance so that they can apply their mathematical knowledge independently.

INDEPENDENT PRACTICE: Student activity sheets and teacher answer sheets are included. Student Activity Sheets are designed to encourage learning and understanding.

EVALUATION: Evaluation methods are suggested to:

- Assess students' understanding of mathematical concepts.
- Bring mathematical closure to the lesson.

HOME ACTIVITY/ EXTENSION: Home Activity Sheets and suggestions for Extension Activities provide additional opportunities for application of mathematical concepts in a variety of situations.

CAMP-LA ASSESSMENT

The purpose of assessment is to enhance learning and improve teaching. For the student, assessment indicates a measure of mathematical knowledge and power. For the teacher, it indicates how the instructional program should be modified. Teacher observation of students' actions and interactions gives information about mathematical knowledge, understanding of concepts, and ability to apply reasoning and analysis to solve problems.

Suggested **CAMP-LA** assessment items appear at the end of each chapter. The assessment items:

- have been written as models of assessment which support the major concepts presented in the **CAMP-LA** lessons;
- provide both open-ended and traditional assessment tasks;
- are meant to be done by pairs and/or small groups;
- indicate anticipated student responses for open-ended questions.

SCOPE AND SEQUENCE

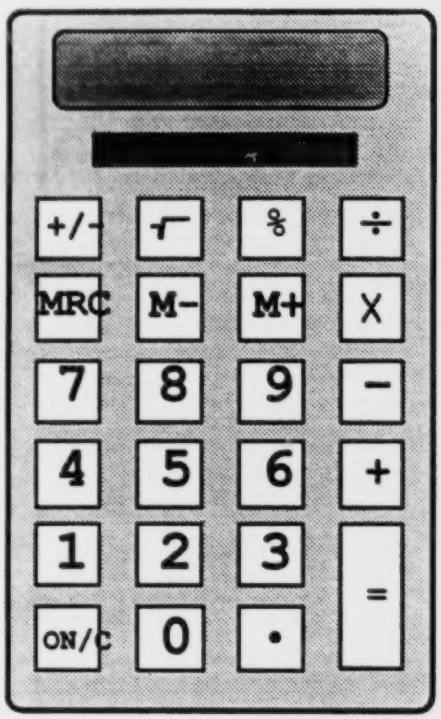
The Calculators and Mathematics Project, Los Angeles fifth and sixth grade lessons are listed in a **suggested order of presentation.** The columns represent the four chapters which cover seven strands of mathematics. Lessons in each column are listed in an order that takes into account both the lesson's difficulty and the prerequisites that are required to successfully complete them.

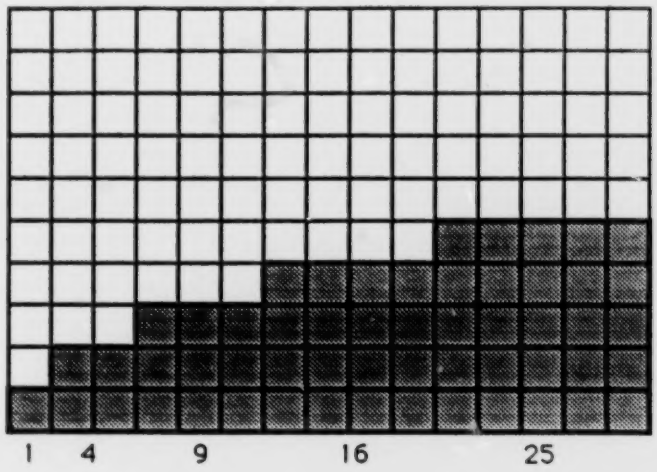
Patterns and Functions	Logic/ Statistics and Probability	Measurement/ Geometry	Number/ Algebra
Lesson 1 Addition Oddities	Lesson 8 Going to the Movies	Lesson 15 Coin Caper	Lesson 27 Leftovers
Lesson 2 Chessboard and the Wheat	Lesson 9 Number Claim	Lesson 16 How Much Money Will I Have?	Lesson 28 Guinness Eggception Facts
Lesson 3 Strange Sequences	Lesson 10 I Love Math	Lesson 17 I Have, Who Has	Lesson 29 EZ Millions Trivia Pursuit
Lesson 4 An Ancient Oddity	Lesson 11 How Fast Can You Run?	Lesson 18 Whats Your Angle?	Lesson 30 Get the Point
Lesson 5 Palatable Patterns	Lesson 12 M & M & M	Lesson 19 Its All In How You Look at it	Lesson 31 Digital Reaction
Lesson 6 Follow the Flow 1	Lesson 13 License to Count	Lesson 20 Circle To The Right	Lesson 32 What Would You Weight on Mars?
Lesson 7 Follow the Flow 2	Lesson 14 What's in the Bag?	Lesson 21 I Search, You Search	Lesson 33 Butcher Math
		Lesson 22 Folding Paper	Lesson 34 Best Buy
		Lesson 23 Easy as Pi	Lesson 35 Popcorn Ball
		Lesson 24 Wheels on the Bike Go Round and Round	Lesson 36 Watch Your Money Grow
		Lesson 25 Which Holds More	Lesson 37 Your Gain Your Loss
		Lesson 26 Chris Up and Down Day	Lesson 38 Decimal Discovery
			Lesson 39 Mystery Spaces
			Lesson 40 Pardon My Dear Aunt Sally

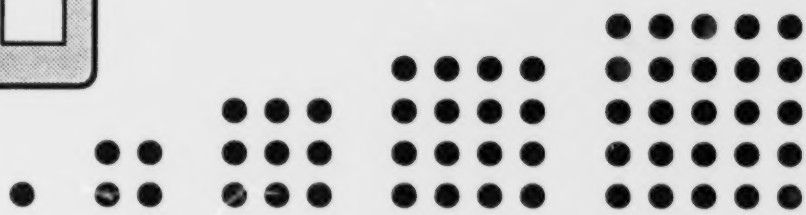
Patterns and Functions	Logic/ Statistics and Probability	Measurement/ Geometry	Number/ Algebra
			Lesson 41 Multiple Madness
			Lesson 42 Dubious Discounts
			Lesson 43 Going Camping
			Lesson 44 Rock N' Math

CAMP-LA

Calculators and Mathematics Project, Los Angeles







Grades 5 - 6

CHAPTER 1
PATTERNS AND FUNCTIONS

ADDITION ODDITIES

GRADE: 5 - 6

STRAND: Patterns and Functions

SKILL: Identify, extend, and create patterns of numbers in addition.

MANAGEMENT

CLASS ORGANIZATION: Small group

TIME FRAME: One math period

MATERIALS: Calculator

VOCABULARY: Addends, digits, place value

PREREQUISITE SKILL: Place Value

LESSON

- **DIRECTED INSTRUCTION:**

  Ask students to arrange three 4's and use only the addition operation to find a sum of 48.

  $$\begin{array}{r} 44 \\ +\ 4 \\ \hline 48 \end{array}$$

  Ask students to arrange four 4's and use only the addition operation to find a sum of 88, then 448, and 52.

  $$\begin{array}{r} 44 \\ +\ 44 \\ \hline 88 \end{array} \qquad \begin{array}{r} 444 \\ +\ 4 \\ \hline 448 \end{array} \qquad \begin{array}{r} 44 \\ 4 \\ +\ 4 \\ \hline 52 \end{array}$$

- **GUIDED PRACTICE:**

  Teacher hands out Student Activity Sheets. Students work problems 1-6.

  1. Students arrange eight 4's and use only the addition operation to find a sum of 500.

  Students work in pairs to:

  Arrange eight 4's to find the sum of 500.
  Use only the addition operation.
  Hint: Digits may be used together (i.e., 44).
  Record what you did.

Answer Key:

$$\begin{array}{r} 444 \\ 44 \\ 4 \\ 4 \\ +\ 4 \\ \hline 500 \end{array}$$

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- **INDEPENDENT PRACTICE:**

2. Use the same place value arrangement with eight 5's. Then with eight 6's.

Record what you did.

Answer Key:

555 55 5 5 + 5 625	666 66 6 6 + 6 750

3. Use the same arrangement with eight 7's, eight 8's, and eight 9's.

Answer Key:

777 77 7 7 + 7 875	888 88 8 8 + 8 1000	999 99 9 9 + 9 1125

4. Record your sums for problems 1 through 3.

Number used	Eight 4's	Eight 5's	Eight 6's	Eight 7's	Eight 8's	Eight 9's
Sum	500	625	750	875	1,000	1,125

5. What is the pattern? Write what you notice.
With each consecutive number (i.e., 7,8) the pattern shows an increase of 125.

6. Use the same arrangement with eight 1's, eight 2's, and eight 3's. Can you find the sum mentally? If not use your calculator.

111 11 1 1 + 1 125	222 22 2 2 + 2 250	333 33 3 3 + 3 375

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ADDITION ODDITIES
Student Activity Sheet

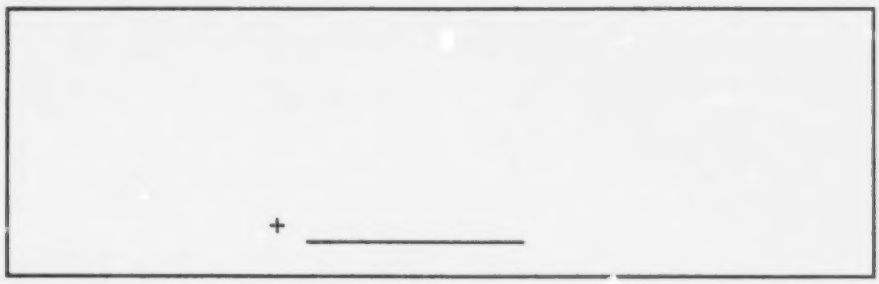
Directions: Work with a partner

1. Arrange eight 4's to find the sum of 500.

   Use only the addition operation.

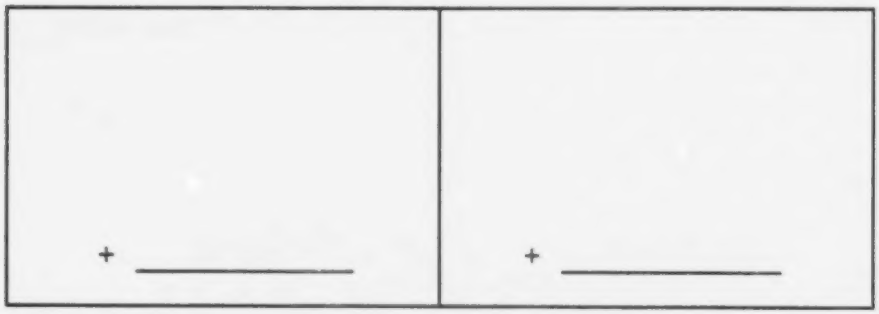
   Hint: Digits may be used together.

   Record what you did.

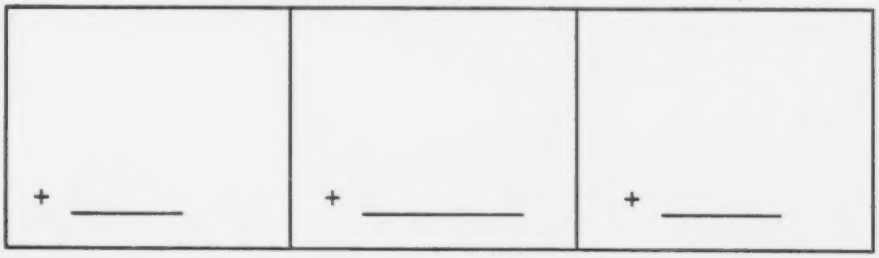


2. Use the same place value arrangement you used in problem 1 only with eight 5's. Then with eight 6's.

   Record what you did.



3. Use the same arrangement with eight 7's, eight 8's, and eight 9's.



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4. Record your sums for problems 1 through 3

Numbers Used	Eight 4 's	Eight 5 's	Eight 6 's	Eight 7 's	Eight 8 's	Eight 9 's
Sum						

5. What is the pattern for the sums? Write what you notice.

6. Use the same arrangement with eight 1's, eight 2's, and eight 3's. Can you find the sum mentally? If not, use your calculator.

7. Create your own addition pattern using another arrangement of eight 1's, 2's, 3's, etc.

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THE CHESSBOARD AND THE WHEAT

GRADE: 5 - 6

STRAND: Patterns and Functions

SKILL: Identify and find powers of numbers.

MANAGEMENT

CLASS ORGANIZATION: Pairs

TIME FRAME: One math period

MATERIALS: Calculator, 2 counters (optional)

VOCABULARY: Raising to a power, exponent

PREREQUISITE SKILL: Multiplication

LESSON

- **DIRECTED INSTRUCTION:**

  Show students how to use the calculator for multiplication by a constant. Remember to clear first. Some calculators may differ.

C	2	X	1	=	=	=	=	(2 is a constant factor)
Result:				2	4	8	16	

C	3	X	1	=	=	=	=	(3 is a constant factor)
Result:				3	9	27	81	

  Discuss the fact that the number of times the equal key is pushed is the same as the power or exponent of the constant factor. Show the overhead transparency 1.

- **GUIDED PRACTICE:**

  Students compute the following:

  2^{10} = (1024) 3^{10} = (59049) 5^5 = (3125)

  7^4 = (2401) 6^3 = (216) 11^7 = (19487171)

  Ask, "Which is larger 7^{11} or 11^7?" Note: 7^{11} causes an overflow error at 7^{10} so 7^{10} is too large a number for the calculator; $7^{11} > 11^7$.

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- **INDEPENDENT PRACTICE:**
  Hand out and have students complete Student Activity Sheet. Discuss results.

- **GUIDED PRACTICE: (Activity 2)**
  Preparation

  Read the story "The Chessboard and the Wheat" to the whole class.

  There is a famous story called "The Chessboard and The Wheat" involving mathematics and an improbable outcome. The story goes like this:

  Once upon a time, a king had a lovely daughter who he wished to have wed. In order to find the best husband possible, the king, who was very rich and had many valuable possessions, offered to give his daughter's hand in marriage to the most clever and creative suitor. He devised a contest where prospective husbands would present the king with their inventions. The purpose of this was to show the king something he had never seen before and something he would find novel and useful.

  Many young men appeared before the king, bearing unique, new inventions and ideas for the king to consider. Some presented plans for new and powerful weapons of war; others presented plans for new techniques for tilling the soil and growing crops. The king was very impressed with these entries to the competition, but the winner was a young man who presented the king with a chessboard and chess pieces. You see, chess had not been invented yet, so it was a new idea.

  The king, upon learning how to play, was so impressed with the wonderful new game of skill and wit, that he offered his daughter's hand in marriage to the young man. He even tossed in a dowry of gold and jewelry.

  The young man had other ideas. He accepted the daughter's hand in marriage but also decided to ask the king to grant him a simple request.

  "Your Highness", he said, "you can keep the gold and jewels. I ask instead that in honor of the new game, you give me one grain of wheat for the first square of the chessboard; two grains of wheat for the second square; four grains of wheat for the third square; eight grains of wheat for the fourth square and so on, doubling the number of the previous square until all 64 squares have been accounted for."

  <Show Transparency 2>

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THE CHESSBOARD AND THE WHEAT

Teacher Answer Sheet

1	2	4	8	16	32	64	128
256	512	1024	2048	4096	8192	16384	32768
65536	131072	262144	524288	1048576	2097152	4194304	8388608
16777216	33554432	67108864	overflow				

The king, thinking this was a modest request, gladly granted the wish of his future son-in-law. After all, the king had many, farmers in his kingdom that produced bushels and bushels of wheat. However after a few days, the king who was also very bright, realized his mistake! But being an admirer of the beauty of mathematics and the cleverness of the young man, he decided to relinquish his throne to the young man after the wedding ceremony. The king retired to the countryside to enjoy his old age and perfect his chess skill.

Students think about the magnitude of this problem.

Ask students, "Why did the king make a mistake by granting the young man's wish? Try and figure out how much wheat the king would have had to pay. Hint: use the calculator key code [C] [2] [x] [1] [-] [-] [-] ...etc. When did the calculator overflow?"

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CONSTANT FACTOR OF 2

C	2	X	1	=	=	=	=	=	=	=	=
RAISING TO A POWER:				2^1	2^2	2^3	2^4	2^5	2^6	2^7	2^8
Result:				2	4	8	16	32	64	128	256

CONSTANT FACTOR OF 3

C	3	X	1	=	=	=	=	=	=	=	=
RAISING TO A POWER:				3^1	3^2	3^3	3^4	3^5	3^6	3^7	3^8
Result:				3	9	27	81	243	729	2187	6561

IF YOU ENTER

C 2 X 1 followed by = = the number of = signs is the same as the <u>power</u> of 2, also called the <u>exponent</u> of 2.

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THE CHESSBOARD AND THE WHEAT

Student Activity Sheet
Teacher Answer Sheet

1. Find the following with your calculator. Begin with [C].

a. 3^6 729 b. 3^7 2187

For 1a: [C] [3] [X] [1] [=] [=] [=] [=] [=] [=]

c. 7^3 343 d. 151^2 22801

e. 35^3 42875 f. 85^4 52200625

2. List the calculator keys you would press to get the following results.
(Begin with [C])

a. 2^5 C 2 X 1 = = = = = b. 5^2 C 5 X 1 = =

c. 8^4 C 8 X 1 = = = = d. 4^8 C 4 X 1 = = = = = = = =

3. List the calculator keys you would press to get the following:
(Begin with [C] - Use the calculator's constant function.)

a. 729 C 3 X 1 = = = = = =
or C 9 x 1 = = =
or C 27 x 1 = =

b. 15625 C 5 X 1 = = = = = =
or C 25 x 1 = = =
or C 125 x 1 = =

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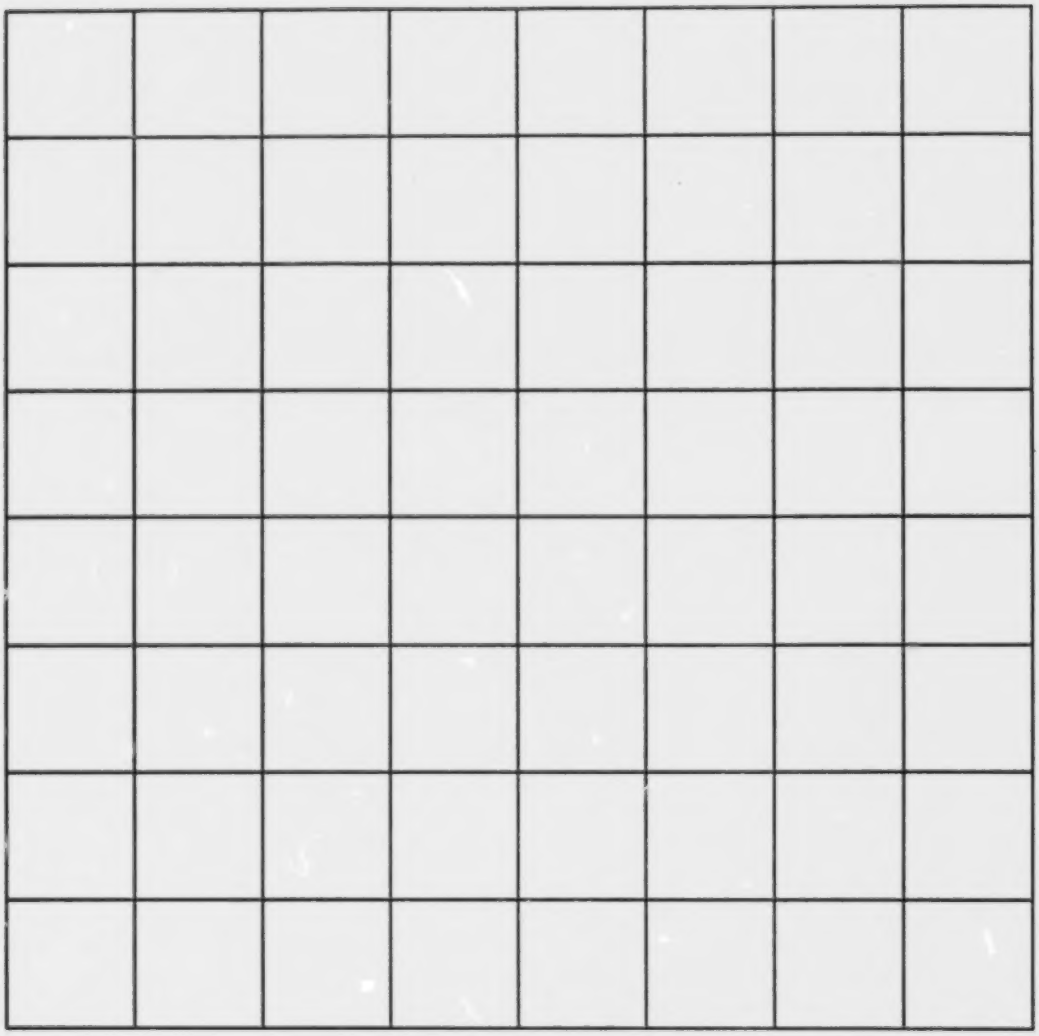
THE CHESSBOARD AND THE WHEAT

(Transparency 2)



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Name _____

THE CHESSBOARD AND THE WHEAT
Student Activity Sheet

1. Find the following with your calculator. Begin with [C].

a. 3^6 _____ b. 3^7 _____

For 1a: [C] [3] [X] [1] [=] [=] [=] [=] [=] [=]

c. 7^3 _____ d. 151^2 _____

e. 35^3 _____ f. 85^4 _____

2. List the calculator keys you would press to get the following:
(Begin with [C])

a. 2^5 _____ b. 5^2 _____

c. 8^4 _____ d. 4^8 _____

3. List the calculator keys you would press to get the following results.
(Begin with [C] Use the calculator's constant function.)

a. 729 _____ b. 15625 _____

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STRANGE SEQUENCES

GRADE: 5 - 6

STRAND: Patterns and Functions

SKILL: Identify, extend, and create number patterns. Discover relationships in number patterns.

MANAGEMENT

CLASS ORGANIZATION: Pairs

TIME FRAME: One math period

MATERIALS: Calculator, (square tiles-optional)

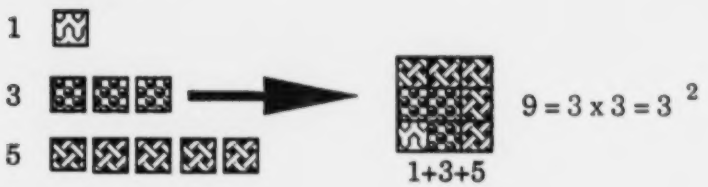
VOCABULARY: Sequence, addend, sums, squares, consecutive

PREREQUISITE SKILL: Square numbers in exponential notation

LESSON

- **DIRECTED and GUIDED INSTRUCTION:**

  Hand out Student Activity Sheet. Begin question 1.
  Students work through the sequence for pattern recognition. They may verify results using square tiles to give a visual representation of the square pattern.
  Example:
  $1 + 3 + 5 = 9 = 3 \times 3 = 3^2$
  (3^2 is read 3 to the second power or 3 squared and means 3 x 3. Three is called the **base** and two is called the **power** or the **exponent**.)



  1 + 3 + 5 is the sum of three consecutive odd addends beginning with 1.

- **INDEPENDENT PRACTICE:**

  Students complete Student Activity Sheet. Discuss results.

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STRANGE SEQUENCES
Student Activity Sheet
Teacher Answer Sheet

Directions: Work with a partner. Fill in the chart.

Sequence	Number of consecutive odd addends
$1 = 1 = 1^2$	1
$1 + 3 = 4 = 2^2$	2
$1 + 3 + 5 = 9 = 3^2$	3
$1 + 3 + 5 + 7 = 16 = 4^2$	4
$1 + 3 + 5 + 7 + 9 = 25 = 5^2$	5
$1 + 3 + 5 + 7 + 9 + 11 = 36 = 6^2$	6
$1 + 3 + 5 + 7 + 9 + 11 + 13 = 49 = 7^2$	7
$1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 = 64 = 8^2$	8
$1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 = 81 = 9^2$	9
$1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 = 100 = 10^2$	10
$1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 = 121 = 11^2$	11

1. Write what you notice about the sums of consecutive odd addends.

   They are square numbers.

2. Write the pattern that would be in the chart for twelve consecutive odd addends.
   $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23 = 12^2 = 144$

3. Show how the pattern works with 20 odd addends; 27 odd addends; 50 odd addends.

   $1 + 3 + 5 + 7 + \ldots + 39 = 400 = 20^2$ $\quad 1 + 3 + 5 + \ldots + 53 = 729 = 27^2$

   $1+3+5+\ldots + 99 = 2500 = 50^2$

4. Write the relationship between the number of consecutive odd addends, their sum, and the square of the number.

   The square (2nd power) of the number of consecutive odd addends = the sum of the numbers in the sequence.

$1+3+5+7+9$

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Name_____

STRANGE SEQUENCES
Student Activity Sheet

Directions: Work with a partner. Fill in the chart.

Sequence	Number of consecutive odd addends
$1 = 1 = 1^2$	1
$1 + 3 = 4 = 2^2$	2
$1 + 3 + 5 = \square = \square^2$	3

1. Write what you notice about the sums of consecutive odd addends.

_____

_____

2. Write the pattern that would be in the chart for twelve consecutive odd addends.

_____

_____

3. Show how the pattern works with 20 odd addends; 27 odd addends; 50 odd addends.

_____

_____

_____

4. Write the relationship between the number of consecutive odd addends, their sum, and the square of the number.

_____

_____

$1+3+5+7+9$

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AN ANCIENT ODDITY

GRADE: 5 - 6

STRAND: Patterns and Functions

SKILL: Discover the pattern relationship between consecutive odd numbers and numbers to the third power. (Cube numbers)

MANAGEMENT

CLASS ORGANIZATION: Individual or pairs

TIME FRAME: One math period

MATERIALS: Calculator, scissors

VOCABULARY: Cubes and squares of numbers, exponential, archaeologist

PREREQUISITE SKILL: Powers of numbers

LESSON

- **DIRECTED INSTRUCTION and GUIDED PRACTICE:**

  Hand out Ancient Stone Tablet part 1 (Student Activity Sheet 1) and read the following motivating story to the class.

  Archaeologists found an old stone tablet buried in the ruins of a destroyed city. Over the centuries some of the numbers on the tablet were damaged.

  Your task is to figure out what the missing numbers are.

  1. Tell the students to complete the blanks on the tablet by filling in the missing numbers to form a pattern. Assist students as needed by telling them the pattern is related to odd numbers.

- **INDEPENDENT PRACTICE:**

  2. Teacher reads: **Years later the Archaeologists found the second part of the tablet.**
     Hand out Ancient Stone Tablet Part 2 (Student Activity Sheet 2).

  3. Students use scissors to cut out the Ancient Stone Tablet. Place the second part of the tablet to the right of the first part.

  4. Have students complete the numbers, and discuss the patterns that were originally written on the tablets.

- **HOME ACTIVITY:**

  Hand out Home Activity Sheet and have students complete the tablet and columns for homework.

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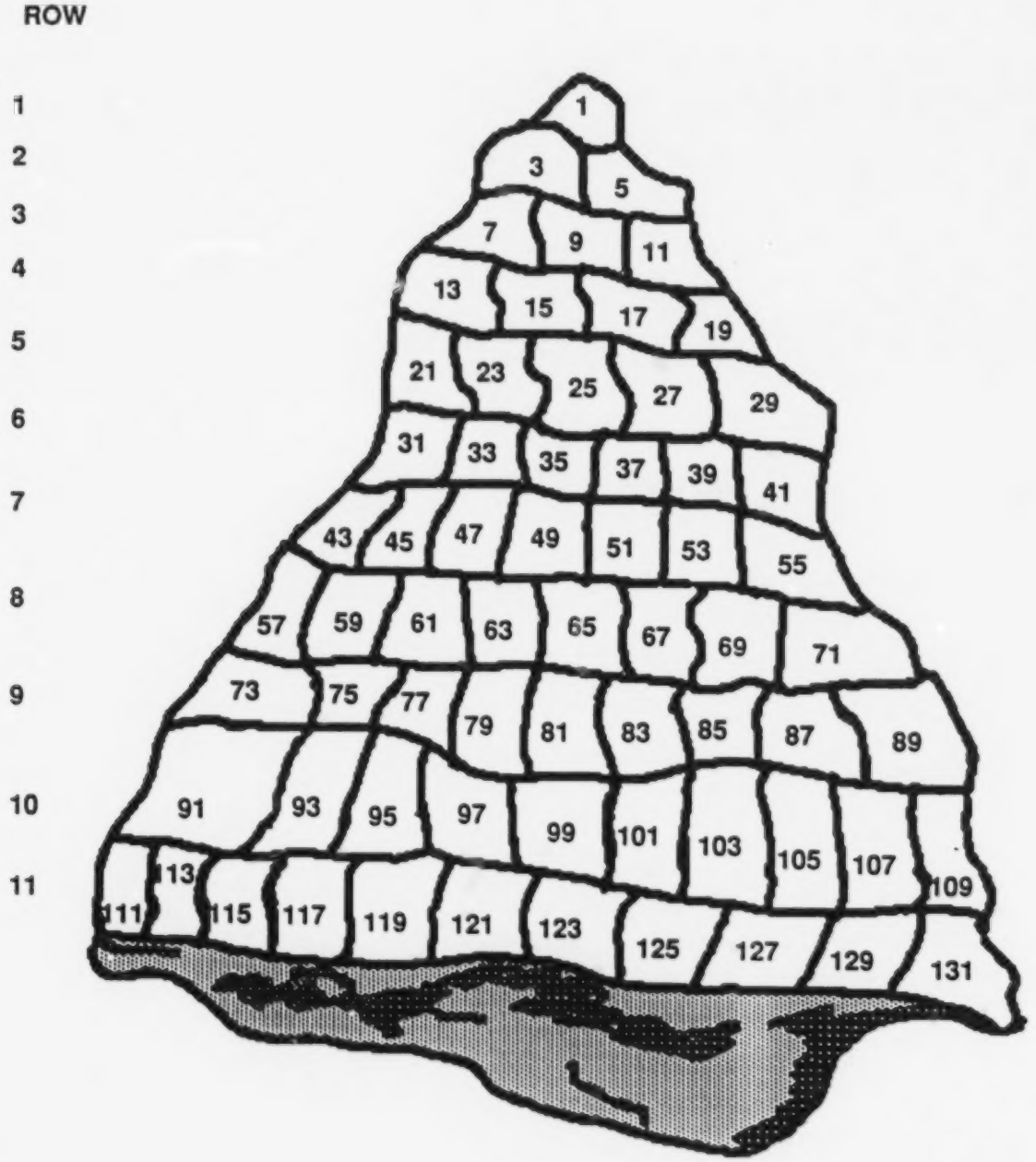
AN ANCIENT ODDITY

Teacher Answer Key - Student Activity Sheet 1

1. Complete the blanks on the tablet by filling in the missing numbers to form a pattern.
2. What do you notice about the numbers on this tablet?



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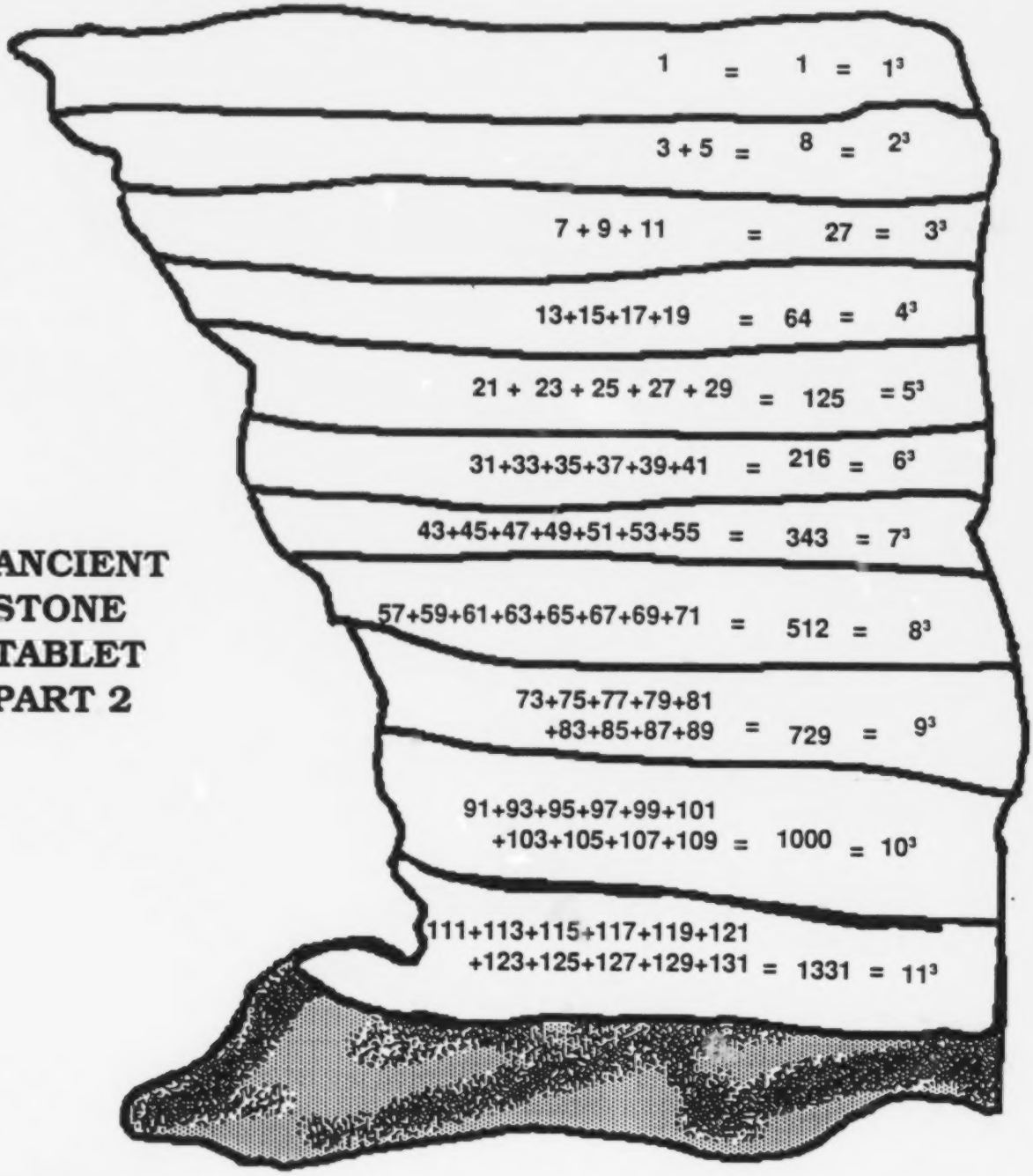
AN ANCIENT ODDITY

Teacher Answer Key - Student Activity Sheet 2

Years later Archaeologists found the second part of the tablet.

1. Cut out or place the two sections of the tablet together so the horizontal lines match.
2. Fill in the missing numbers to discover the pattern on the Ancient Tablet. What did you discover?

Teacher Note: The next to the last column consists of cube numbers. i.e. numbers found by multiplying a number by itself three times.
Example: $64 = 4 \times 4 \times 4$



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AN ANCIENT ODDITY
Teacher Answer Key - Home Activity Sheet

Row	ANCIENT STONE TABLET	A	B
1	1	1	1
2	1 3	4	2^2
3	1 3 5	9	3^2
4	1 3 5 7	16	4^2
5	1 3 5 7 9	25	5^2
6	1 3 5 7 9 11	36	6^2
7	1 3 5 7 9 11 13	49	7^2
8	1 3 5 7 9 11 13 15	64	8^2
9	1 3 5 7 9 11 13 15 17	81	9^2
10	1 5 7 9 11 13 15 17 19	100	10^2
11	1 3 5 7 9 11 13 15 17 19 21	121	11^2

The sum of the numbers in each row of tablet is to be written in column A. The row number raised to the second power is placed in column B.
Example: 1+3+5 =9 which is 3^2 or 3x3.
In row 25 you will have column A = 625 and column B = 25^2

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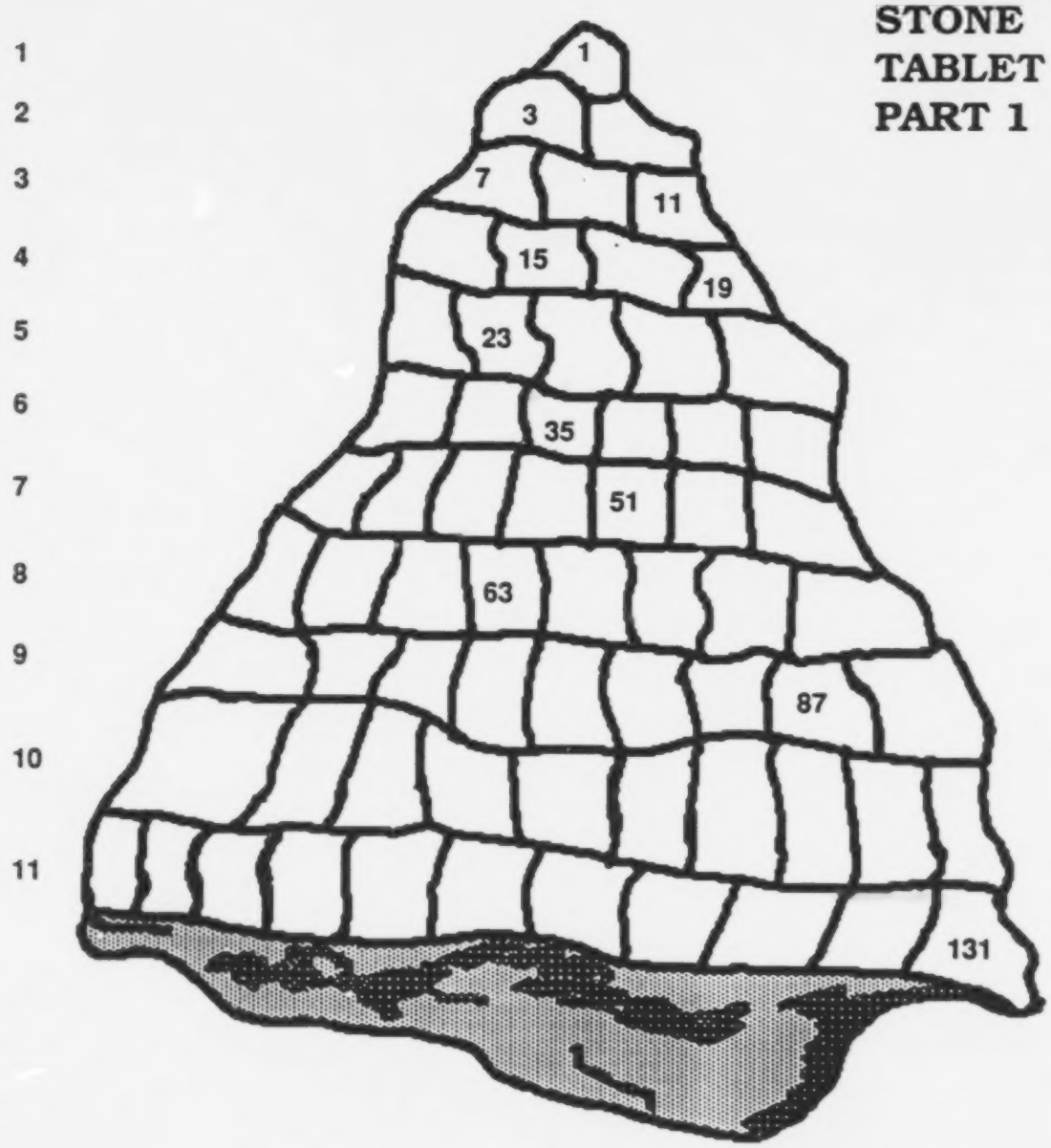
AN ANCIENT ODDITY

Student Activity Sheet 1

1. Complete the blanks on the tablet by filling in the missing numbers to form a pattern.
2. What do you notice about the numbers on this tablet?

ROW

ANCIENT STONE TABLET PART 1



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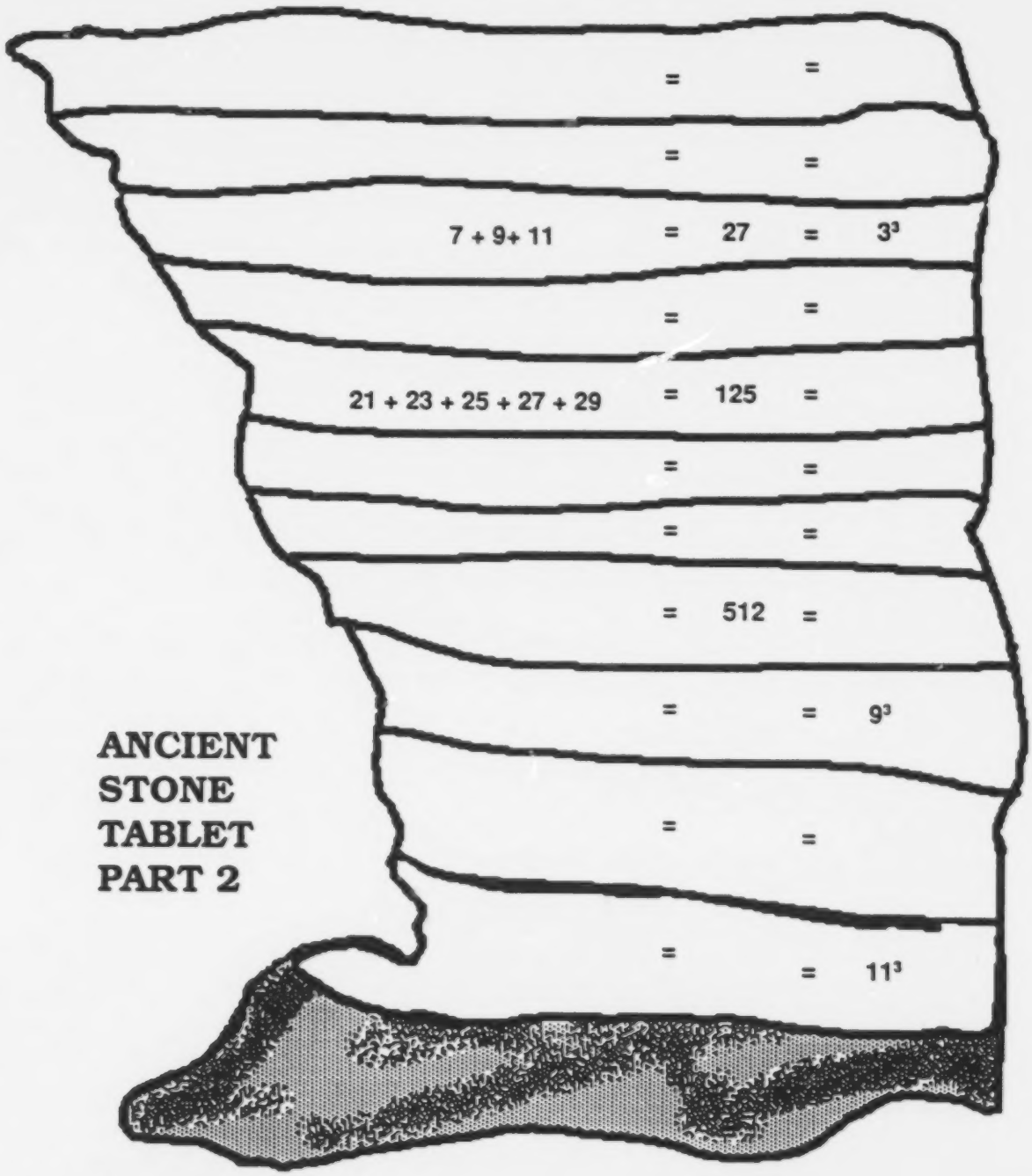
Name _____

AN ANCIENT ODDITY
Student Activity Sheet 2

Years later Archaeologists found the second part of the tablet.

1. Cut out or place the two sections of the tablet together so the rows line up.
2. Fill in the missing numbers to discover the pattern on the Ancient Tablet. What did you discover?



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Name _____

AN ANCIENT ODDITY

Home Activity Sheet

1. Complete the blanks on the tablet by filling in the missing number to form a pattern.
2. Use the numbers of each row to complete column A and B.
   (Hint: What kind of numbers are found in the tablet.)

Row	ANCIENT STONE TABLET	A	B
1	1	1	
2	3		2^2
3			
4	1	16	
5	1		
6	5 9	36	
7	7		
8	1 15		
9	11		9^2
10	1 7		
11	21		

What are the numbers for columns A and B in row 25? _____

How does this tablet differ from the other Stone Tablets? _____

_____

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PALATABLE PATTERNS

GRADE: 5 - 6

STRAND: Patterns and Functions

SKILL: Add or divide a number by a one or a multi-digit number

MANAGEMENT

CLASS ORGANIZATION: Pairs

TIME FRAME: One math period

MATERIALS: Calculator, overhead transparency

VOCABULARY: Quotient, reverse, digits, even numbers

PREREQUISITE SKILL: Division

LESSON

- **DIRECTED INSTRUCTION/ GUIDED PRACTICE:**
  Lead students to discover, extend, and create numbers patterns. Use an overhead projector to demonstrate.

- **INDEPENDENT PRACTICE:**
  Hand out Student Activity Sheet.

  Have students complete the charts and answer the question. Guide the students through the first few examples. Assist as needed. Discuss their observations such as: the quotients are all whole numbers.

- **EXTENSION:**
  Hand out and have students complete the Extension Activity Sheet. Students use numbers with an odd number of digits. Ask them if they will still get a quotient that is a whole number. After they answer, you can give them examples like 352 which will workout correctly. Then give 735 which will not work. (735 + 537) + 11 is not a whole number.

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PALATABLE PATTERNS
Transparency

Work with a partner.

1. Choose any number with an even number of digits.

2. Reverse the order of the digits.

3. Use your calculator to add the two numbers.

4. Divide the sum by 11. Is the quotient a whole number? Will it always be a whole number?

56	Addend	5681	Addend
+65	Reverse addend	+1865	Reverse Addend
121		7546	

121 ÷ 11 = 11 7546 ÷ 11 = 686

The quotients 11 and 686 are whole numbers

	Number	Reverse order	Sum	Sum ÷ 11
Example 1	56	65	121	121 ÷ 11 = 11
Example 2	5681	1865	7546	7546 ÷ 11= 686
Example 3	2345			

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PALATABLE PATTERNS
Student Activity Sheet
Teacher Answer Sheet

Complete the chart.

	Number	Reverse Order	Sum	Sum divided by 11
	5681	1865	7546	7546 ÷ 11 = 686
1	73	37	110	110 ÷ 11 = 10
2	97	79	176	176 ÷ 11 = 16
3	1112	2111	3223	3223 ÷ 11 = 293
4	3057	7503	10,560	10,560 ÷ 11 = 960
5	6935	5396	12,331	12,331 ÷ 11 = 1121
6	5009	9005	14,014	14,014 ÷ 11 = 1274
7	112,526	625,211	737,737	737,737 ÷ 11 = 67,067
8	727,575	575,727	1,303,302	1,303,302 ÷ 11 = 118,482
9	27,848,381	18,384,872	46,233,253	46,233,253 ÷ 11 = 4,203,023
10	67,132,203	30,223,176	97,355,379	97,355,379 ÷ 11 = 8,850,489

Choose numbers with an <u>even number of digits</u> and complete the chart.

	Number	Reverse Order	Sum	Sum divided by 11
1	Answers will vary			
2				
3				
4				
5				
6				
7				
8				
9				
10				

What do you observe about the quotients? _____

_____ When the original number has an even number of digits, the number you get by finding the sum, as above, is always divisible by 11. You always get a whole number quotient.

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Name _____

PALATABLE PATTERNS

Student Activity Sheet

Complete the chart.

	Number	Reverse Order	Sum	Sum divided by 11
	5681	1865	7546	7546 ÷ 11 = 686
1	73			
2	97			
3	1112			
4	3057			
5	6935			
6	5009			
7	112,526			
8	727,575			
9	27,848,381			
10	67,132,203			

Choose numbers with an <u>even number of digits</u> and complete the chart.

	Number	Reverse Order	Sum	Sum divided by 11
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

What do you observe about the quotients? _____

_____

_____

_____

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Name _____

PALATABLE PATTERNS
Extension Activity Sheet

Choose numbers with an odd number of digits and complete the chart.

	Number	Reverse Order	Sum	Sum divided by 11
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

What do you observe about the quotients? _____

_____

_____

_____

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FOLLOW THE FLOW CHART 1

GRADE: 5 - 6

STRAND: Patterns and Functions

SKILL: Identify, extend, and create number sequences.

MANAGEMENT

CLASS ORGANIZATION: Pairs

TIME FRAME: One or two math periods.

MATERIALS: Calculator, overhead calculator, overhead transparency

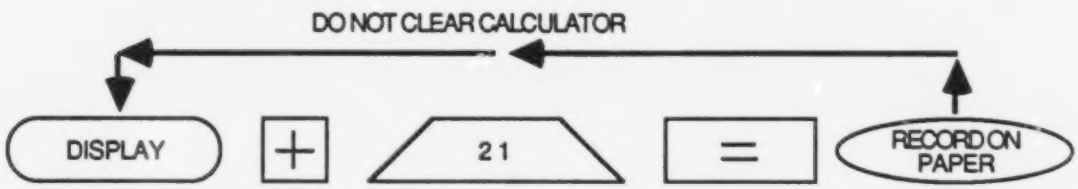
VOCABULARY: Sequence, flow chart

PREREQUISITE SKILLS: Understand a flow chart.

LESSON

- **DIRECTED INSTRUCTION & GUIDED PRACTICE:**

  This lesson will help students create and recognize number sequences.
  Hand out Student Activity Sheet 1.
  Use flow chart transparency to help students follow the steps to complete problems 1 and 2. As they work through the sequence, have them predict the next number and then check it by following the directions on the flow chart.



[1] 56, 77, ___, ___, ___, ___, ___, ___

[2] 111, 132, ____, ____, ____, ____, ____, ____

- **INDEPENDENT PRACTICE:**

  Have students complete Student Activity Sheet 1. Discuss results, including their discoveries about the constant function.

  Hand out and have students complete Student Activity Sheets 2-4.

  Have students observe the sequences. They fill in the blanks on the flow charts with the missing operation and number and complete the sequences. Be sure students check to determine if their answers are reasonable. Have students or groups fill in their own flow charts to create sequences.

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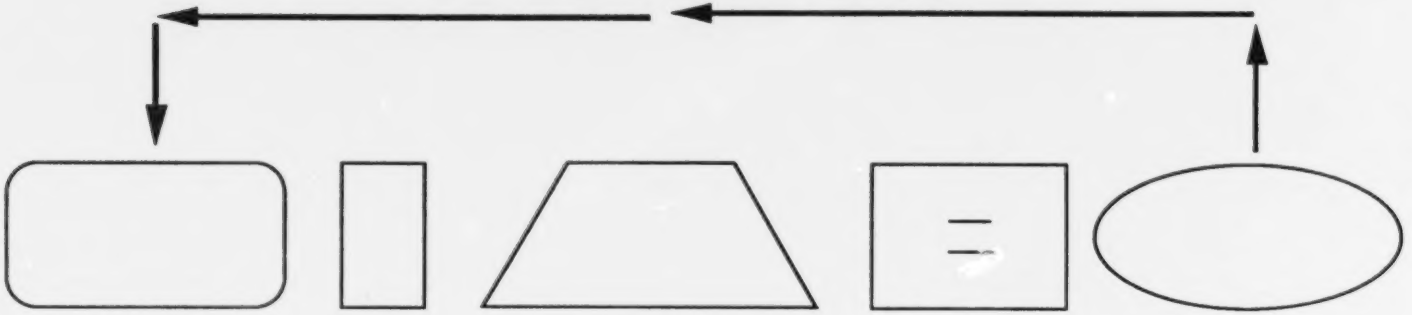
FOLLOW THE FLOW CHART 1 OVERHEAD TRANSPARENCY

DO NOT CLEAR CALCULATOR



STARTING NUMBER _____ . _____ . _____ . _____ . _____ . _____ . _____

STARTING NUMBER _____ . _____ . _____ . _____ . _____ . _____ . _____

STARTING NUMBER _____ . _____ . _____ . _____ . _____ . _____ . _____

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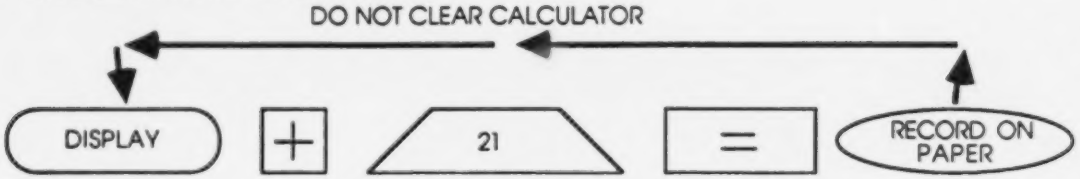
FOLLOW THE FLOW CHART 1
Student Activity Sheet 1
Teacher Answer Key

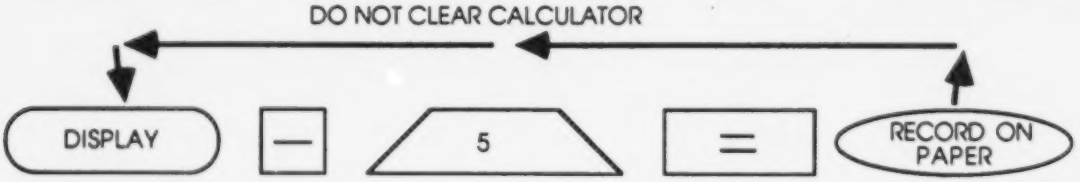
1. Enter the first number in the list on the calculator.
2. Follow the steps in the flow chart to develop a sequence.
3. Clear the calculator between problems.



A

1) 56 . 77 . 98 . 119 . 140 . 161 . 182 . 203

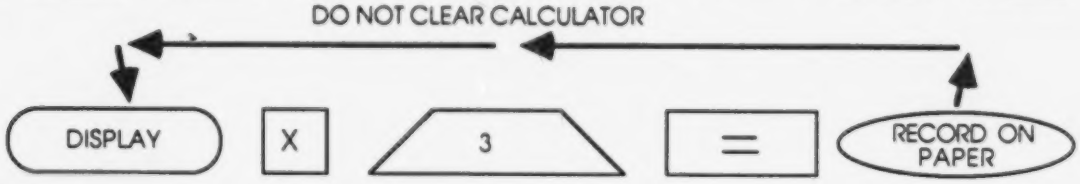
2) 111 . 132 . 153 . 174 . 195 . 216 . 237 . 258



B

3) 48 . 43 . 38 . 33 . 28 . 23 . 18 . 13

4) 102 . 97 . 92 . 87 . 82 . 77 . 72 . 67



C

5) 12 . 36 . 108 . 324 . 972 . 2916 . 8748 . 26244

6) 123 . 369 . 1107 . 3321 . 9963 . 29889 . 89667 . 269001

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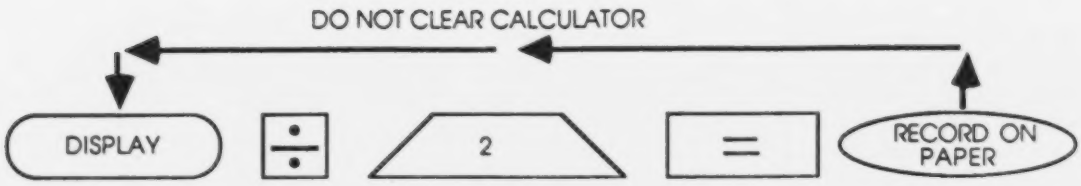
FOLLOW THE FLOW CHART 1

Student Activity Sheet 1
Teacher Answer Sheet



D

7) 3072 , 1536 , 768 , 384 , 192 , 96 , 48 , 24

8) 256 , 128 , 64 , 32 , 16 , 8 , 4 , 2

Use the following calculator shortcuts to check your answers to problems 1 - 8. The shortcuts use the calculator's constant function.

Check to see that the numbers displayed each time you press [=] matched your recorded answers. Clear the calculator between problems.

Sequence	1	Press	56 + 21	= = = = = = =
	2	Press	111 + 21	= = = = = = =
	3	Press	48 - 5	= = = = = = =
	4	Press	102 - 5	= = = = = = =
	5	Press	3 x 12	= = = = = = =
	6	Press	3 x 123	= = = = = = =
	7	Press	3072 ÷ 2	= = = = = = =
	8	Press	256 ÷ 2	= = = = = = =

Explain what you discovered about how the constant function works for the different operations.

In multiplication, enter the constant multiplier before the operation symbol.
In addition, subtraction, and division, enter the constant number after the operation symbol.

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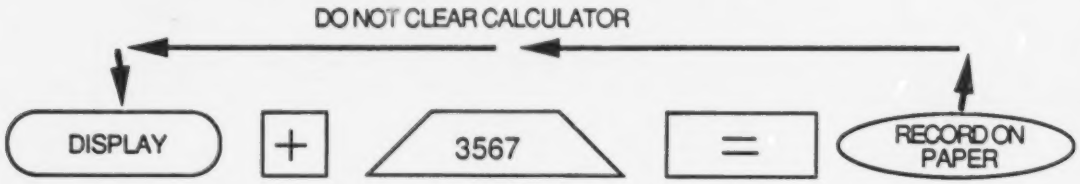
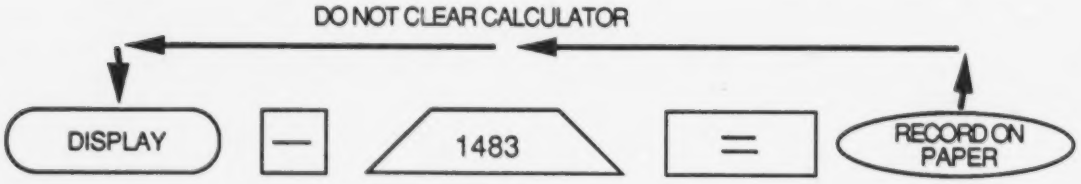
FOLLOW THE FLOW CHART 1
Student Activity Sheet 2
Teacher Answer Sheet

Use the CONSTANT FUNCTION to complete the following sequences.



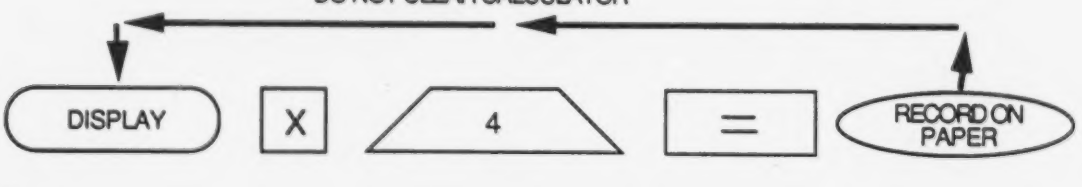
A

7 , 3574 , 7141 , 10708 , 14275 , 17842 , 21409



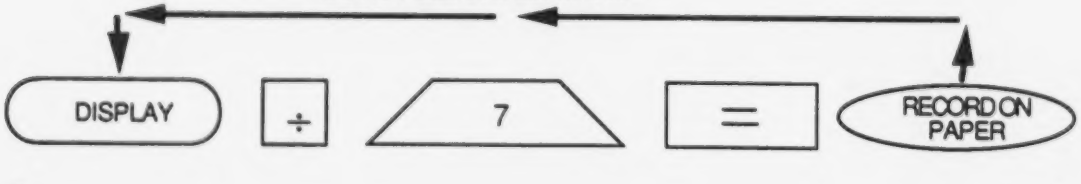
B

10,000 , 8517 , 7034 , 5551 , 4068 , 2585 , 1102



C

14 , 56 , 224 , 896 , 3584 , 14336 , 57344



D

40353607 , 5764801 , 823543 , 117649 , 16807 , 2401 , 343

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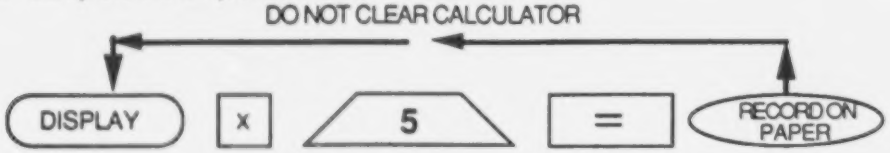
FOLLOW THE FLOW CHART 1

Student Activity Sheet 3

Teacher Answer Key

1. Look at the number sequence.
2. Fill in the flow chart to show how the sequences were created.
3. Complete the sequences under each flow chart.

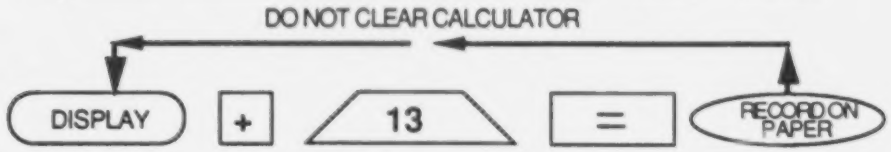


A

1) 1 , 5 , 25 , 125 , 625 , 3125 , 15625

2) 2 , 10 , 50 , 250 , 1250 , 6250 , 31250

3) 8 , 40 , 200 , 1000 , 5000 , 25000 , 125000

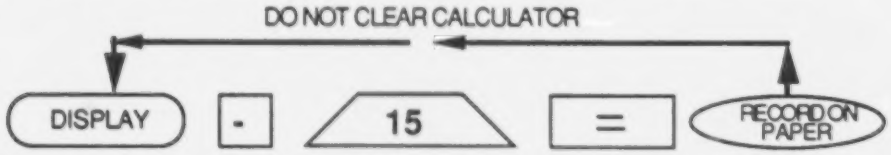


B

1) 28 , 41 , 54 , 67 , 80 , 93 , 106

2) 2070 , 2083 , 2096 , 2109 , 2122 , 2135 , 2148

3) 75 , 88 , 101 , 114 , 127 , 140 , 153

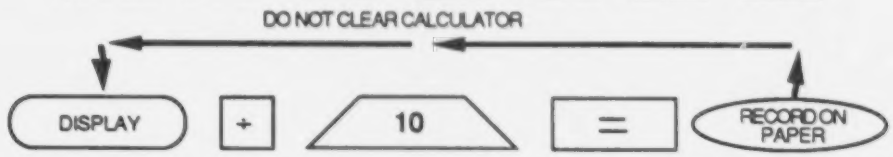


C

1) 100 , 85 , 70 , 55 , 40 , 25 , 10

2) 93 , 78 , 63 , 48 , 33 , 18 , 3

3) 250 , 235 , 220 , 205 , 190 , 175 , 160



D

1) 10,000 , 1,000 , 100 , 10 , 1 , 0.1 , 0.01

2) 500,000 , 50,000 , 5,000 , 500 , 50 , 5 , .5

3) 280 , 28 , 2.8 , 28 , .028 , .0028 , .00028

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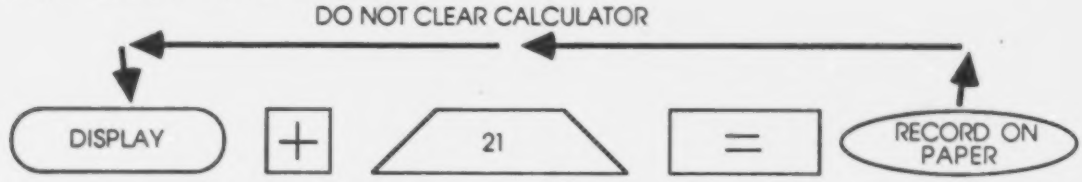
Name _____

FOLLOW THE FLOW CHART 1

Student Activity Sheet 1

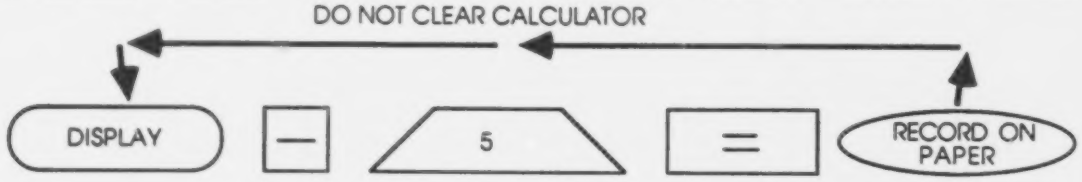
1. Enter the first number in the list on the calculator.
2. Follow the steps in the flow chart to develop a sequence.
3. Clear the calculator between problems.



A

1) 56, 77, ____, ____, ____, ____, ____, ____

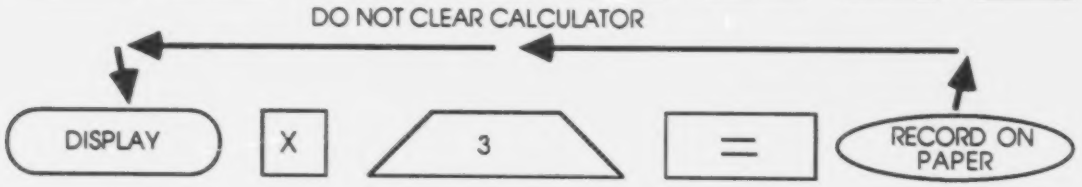
2) 111, 132, ____, ____, ____, ____, ____, ____



B

3) 48, ____, ____, ____, ____, ____, ____, ____

4) 102, ____, ____, ____, ____, ____, ____, ____



C

5) 12, ____, ____, ____, ____, ____, ____, ____

6) 123, ____, ____, ____, ____, ____, ____, ____

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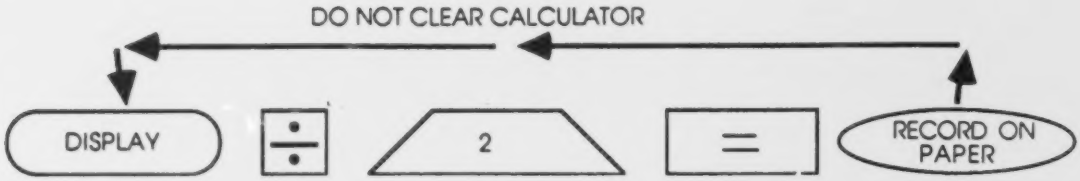
Name _____

FOLLOW THE FLOW CHART 1
Student Activity Sheet 1



D

7) 3072 . _____ . _____ . _____ . _____ . _____ . _____ . _____ . _____

8) 256 . _____ . _____ . _____ . _____ . _____ . _____ . _____ . _____

Use the following calculator shortcuts to check your answers to problems 1 - 8. The shortcuts use the calculator's constant function.

Check to see that the numbers displayed each time you press [=] matched your recorded answers. Clear the calculator between problems.

Sequence	1	Press	56 + 21	= = = = = = =
	2	Press	111 + 21	= = = = = = =
	3	Press	48 - 5	= = = = = = =
	4	Press	102 - 5	= = = = = = =
	5	Press	3 x 12	= = = = = = =
	6	Press	3 x 123	= = = = = = =
	7	Press	3072 ÷ 2	= = = = = = =
	8	Press	256 ÷ 2	= = = = = = =

Explain what you discovered about how the constant function works for the different operations. _____

_____

_____

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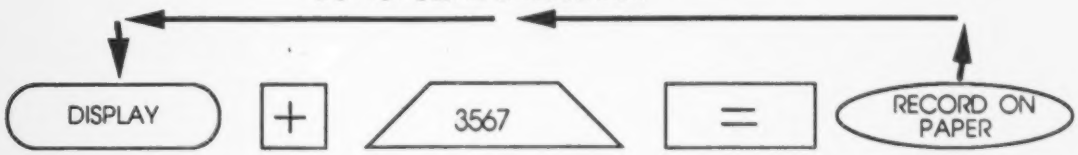
Name _____

FOLLOW THE FLOW CHART 1
Student Activity Sheet 2

Use the CONSTANT FUNCTION to complete the following sequences.

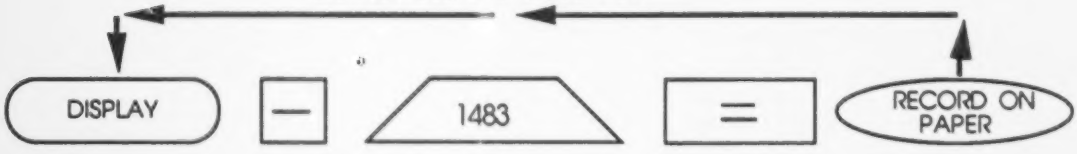
DO NOT CLEAR CALCULATOR



A

7 , ____ , ____ , ____ , ____ , ____ , ____

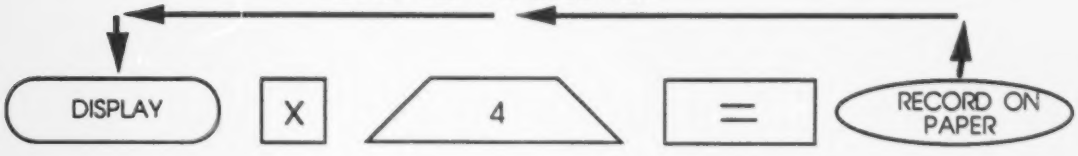
DO NOT CLEAR CALCULATOR



B

10,000 , ____ , ____ , ____ , ____ , ____ , ____

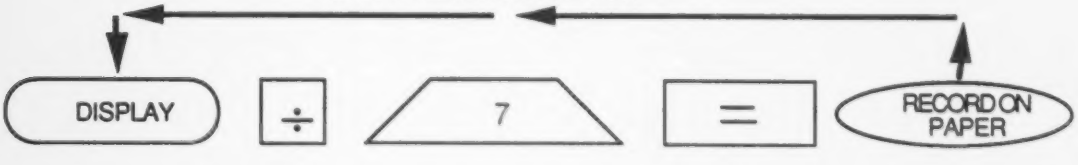
DO NOT CLEAR CALCULATOR



C

14 , ____ , ____ , ____ , ____ , ____ , ____

DO NOT CLEAR CALCULATOR



D

40353607 , ____ , ____ , ____ , ____ , ____ , ____

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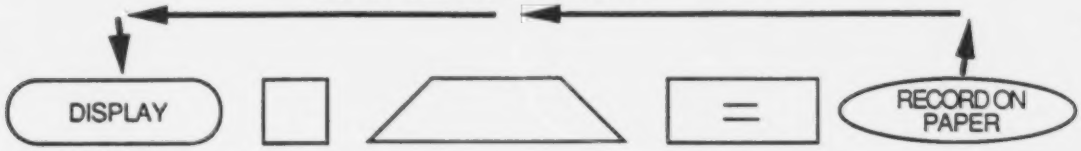
Name _____

FOLLOW THE FLOW CHART 1

Student Activity Sheet 3

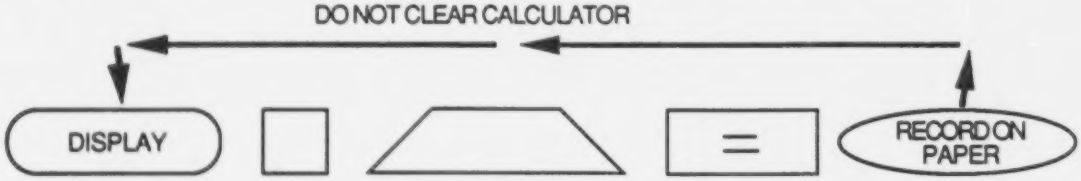
1. Look at the number sequence.
2. Fill in the flow chart to show how the sequences were created.
3. Complete the sequences under each flow chart.

DO NOT CLEAR CALCULATOR



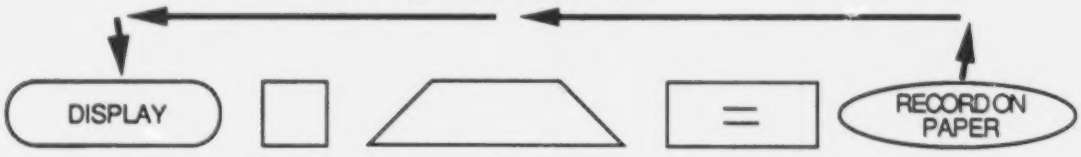
A
1) 1 , 5 , 25 , 125 , 625 , _____ , _____
2) 2 , 10 , 50 , _____ , _____ , _____ , _____
3) 8 , _____ , _____ , _____ , _____ , _____ , _____

DO NOT CLEAR CALCULATOR



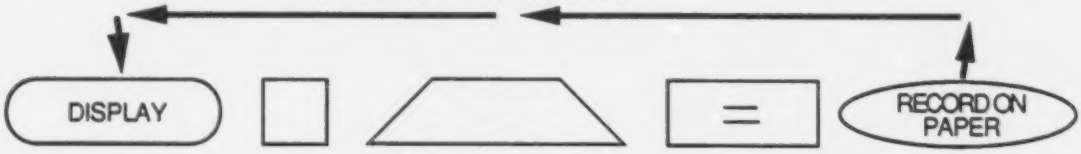
B
1) 28 , 41 , 54 , 67 , 80 , 93 , _____
2) 2070 , 2083 , 2096 , _____ , _____ , _____ , _____
3) 75 , _____ , _____ , _____ , _____ , _____ , _____

DO NOT CLEAR CALCULATOR



C
1) 100 , 85 , 70 , 55 , 40 , 25 , _____
2) 93 , 78 , 63 , _____ , _____ , _____ , _____
3) 250 , _____ , _____ , _____ , _____ , _____ , _____

DO NOT CLEAR CALCULATOR



D
1) 10,000 , 1,000 , 100 , 10 , 1 , 0.1 , 0.01
2) 500,000 , 50,000 , 5,000 , _____ , _____ , _____ , _____
3) 280 , _____ , _____ , _____ , _____ , _____ , _____

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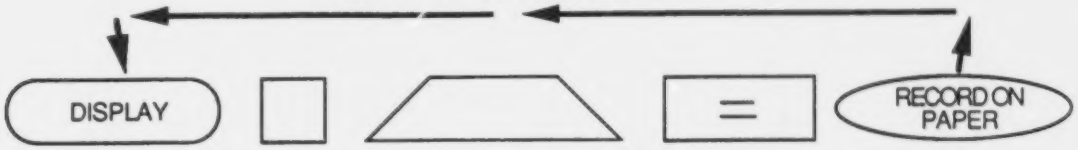
Name_____

FOLLOW THE FLOW CHART 1

Student Activity Sheet 4

1. Work in cooperative groups.
2. Design your own number sequences.

DO NOT CLEAR CALCULATOR



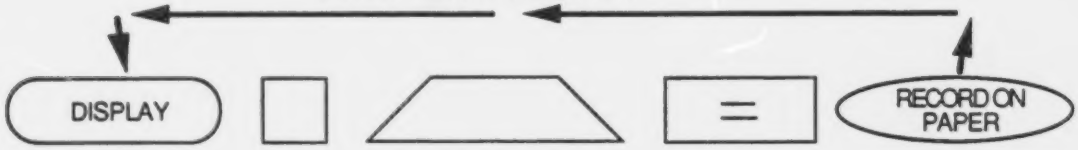
A

1) _____, _____, _____, _____, _____, _____, _____

2) _____, _____, _____, _____, _____, _____, _____

3) _____, _____, _____, _____, _____, _____, _____

DO NOT CLEAR CALCULATOR



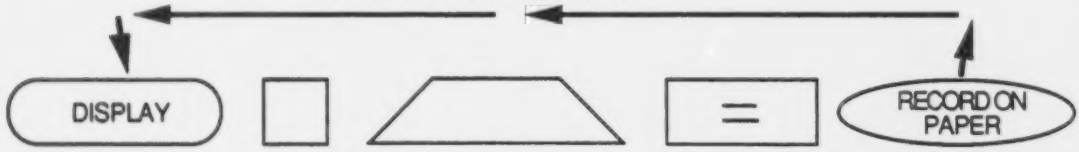
B

1) _____, _____, _____, _____, _____, _____, _____

2) _____, _____, _____, _____, _____, _____, _____

3) _____, _____, _____, _____, _____, _____, _____

DO NOT CLEAR CALCULATOR



C

1) _____, _____, _____, _____, _____, _____, _____

2) _____, _____, _____, _____, _____, _____, _____

3) _____, _____, _____, _____, _____, _____, _____

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FOLLOW THE FLOW CHART 2

GRADE: 5 - 6

STRAND: Patterns and Functions

SKILL: Identify, extend, and create number sequences.

MANAGEMENT

CLASS ORGANIZATION: Pairs

TIME FRAME: One or two math periods.

MATERIALS: Calculator, overhead calculator, overhead transparency

VOCABULARY: Sequence, flow chart, input, output

PREREQUISITE SKILL: Understand a flow chart. (If students do not have flow chart experience they should first complete Lesson 6.)

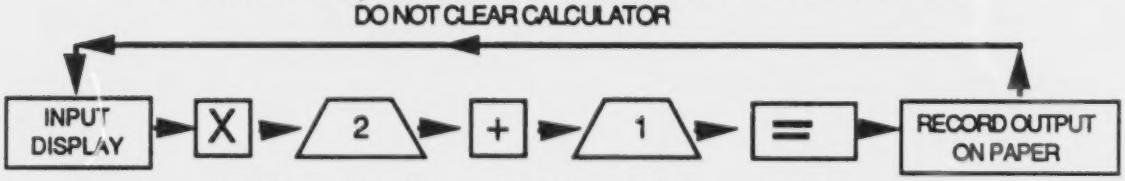
LESSON

- **DIRECTED INSTRUCTION:**
  This lesson will help students understand sequences involving 2 operations.
  Hand out Student Activity Sheet 1.
  Use flow chart transparency to show students how to do problem A

Answer to A:

- Enter 11 in the calculator.
- After following all the operations in the flow chart you get an output of 23.
- Record the 23 below the flow chart.
- Use the 23 as the next input. Again follow the operations on the flow chart.
- Record the 47.
- Continue this process until each blank below the flow chart is filled.

DO NOT CLEAR CALCULATOR



1) 11 2) 23 3) 47 4) 95 5) 191 6) 383 7) 767

- **GUIDED PRACTICE:**
  Students work problem B. Check their work by going over B on the overhead.

- **INDEPENDENT PRACTICE:**
  Students complete Student Activity Sheet 1(C-E) and check their work. Hand out Student Activity Sheet 2. It is more challenging than the previous sheet as it involves completing the sequence and the flow chart. Have students complete the sequences and then discuss their results.

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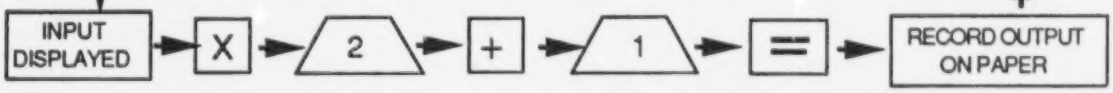
FOLLOW THE FLOW CHART 2

Student Activity Sheet 1
Teacher Answer Key

1. Enter the first number in the list on the calculator.
2. Follow the steps in the flow chart to develop a sequence.
3. Clear [C] the calculator between problems.

DO NOT CLEAR CALCULATOR

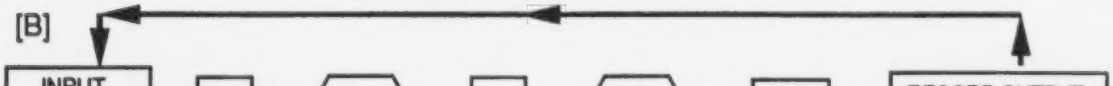
[A]



11 23 47 95 191 383 767

DO NOT CLEAR CALCULATOR

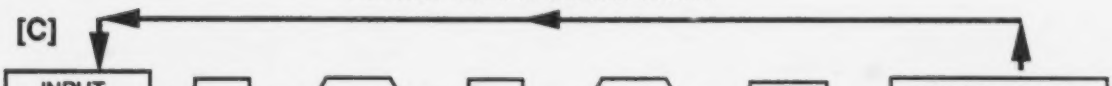
[B]



20 58 172 514 1540 4618 13852

DO NOT CLEAR CALCULATOR

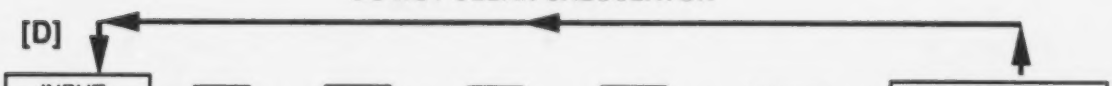
[C]



8200 4104 2056 1032 520 264 136

DO NOT CLEAR CALCULATOR

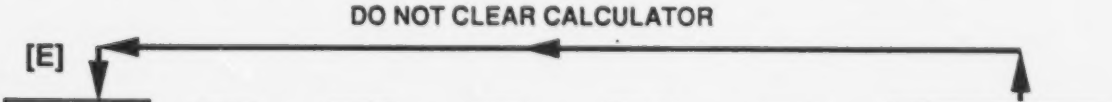
[D]



3 20 156 1244 9948 79580 636636

DO NOT CLEAR CALCULATOR

[E]



1200 1300 1400 1500 1600 1700 1800

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FOLLOW THE FLOW CHART 2

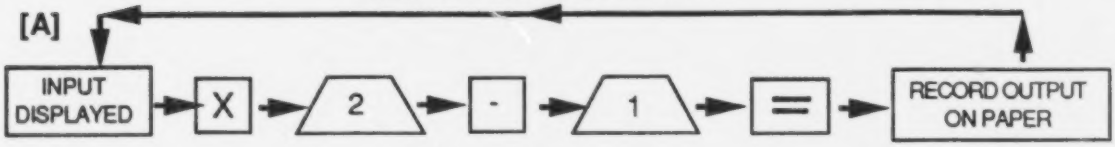
Student Activity Sheet 2

Teacher Answer Key

1. Look at the number sequence.
2. Fill in the missing items on the flow charts.
3. Complete the sequences in each example using the flow chart.

DO NOT CLEAR CALCULATOR

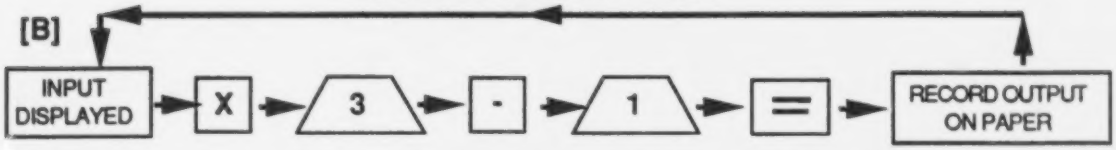
[A]



8 15 29 57 113 225 449 897 1793

DO NOT CLEAR CALCULATOR

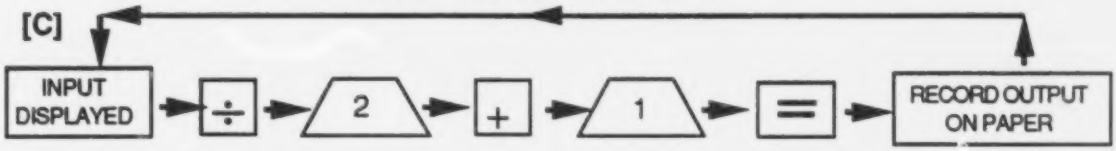
[B]



8 23 68 203 608 1823 5468 16403 49208

DO NOT CLEAR CALCULATOR

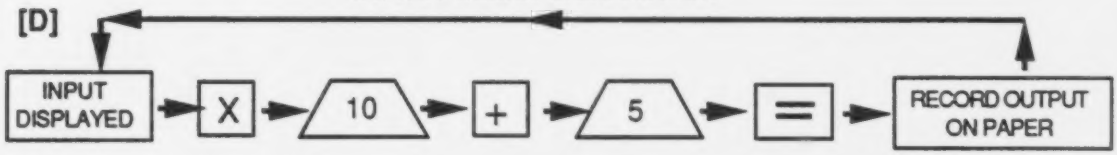
[C]



5378 2690 1346 674 338 170 86 44 23

DO NOT CLEAR CALCULATOR

[D]

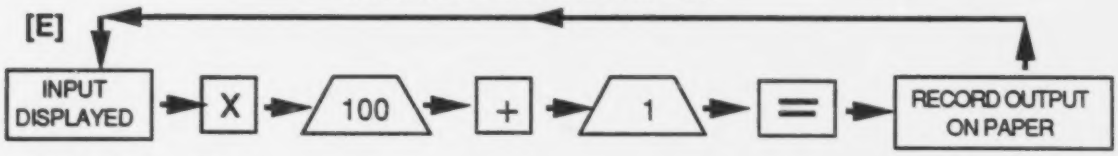


1 15 155 1555 15555 155555 1555555 15555555

3 35 355 3555 35555 355555 3555555 35555555

DO NOT CLEAR CALCULATOR

[E]



1 101 10101 1010101 101010101 10101010101

3 301 30101 3010101 301010101 30101010101

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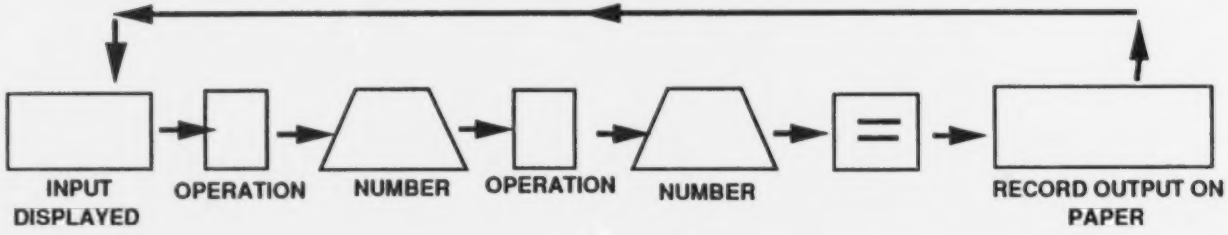
FOLLOW THE FLOW CHART 2 OVERHEAD TRANSPARENCY

DO NOT CLEAR CALCULATOR



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Name_____

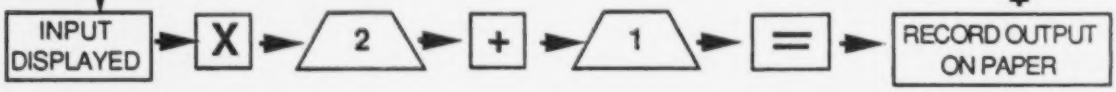
FOLLOW THE FLOW CHART 2

Student Activity Sheet 1

1. Enter the first number in the list on the calculator.
2. Follow all the steps in the flow chart to develop a sequence.
3. Clear [C] the calculator between problems.

DO NOT CLEAR CALCULATOR

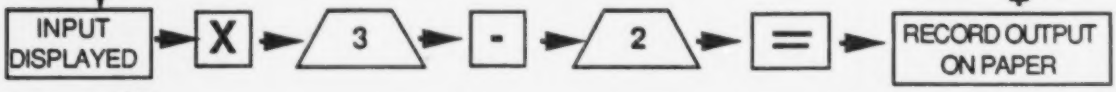
[A]



11 ____ ____ ____ ____ ____ ____

DO NOT CLEAR CALCULATOR

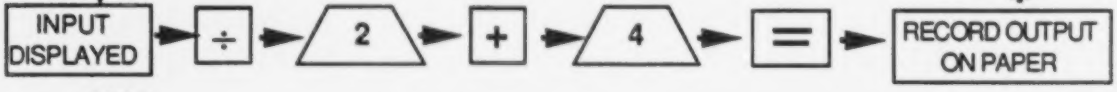
[B]



20 ____ ____ ____ ____ ____ ____

DO NOT CLEAR CALCULATOR

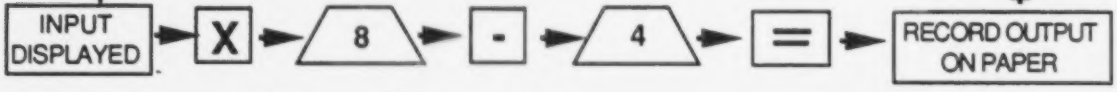
[C]



8200 ____ ____ ____ ____ ____ ____

DO NOT CLEAR CALCULATOR

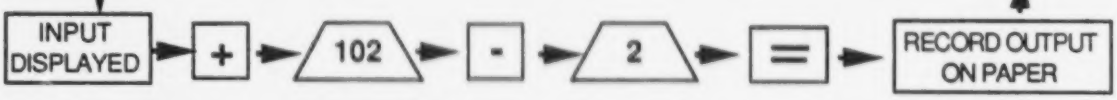
[D]



3 20 156 1244 ____ ____ ____

DO NOT CLEAR CALCULATOR

[E]



1200 1300 1400 ____ ____ ____ ____

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Name_____

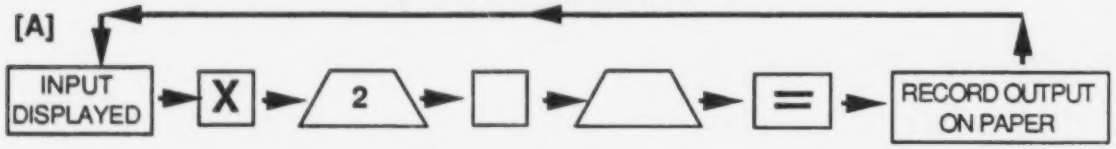
FOLLOW THE FLOW CHART 2

Student Activity Sheet 2

1. Look at the number sequence.
2. Fill in the missing items in the flow charts.
3. Complete the sequences in each example using the flow chart.

DO NOT CLEAR CALCULATOR

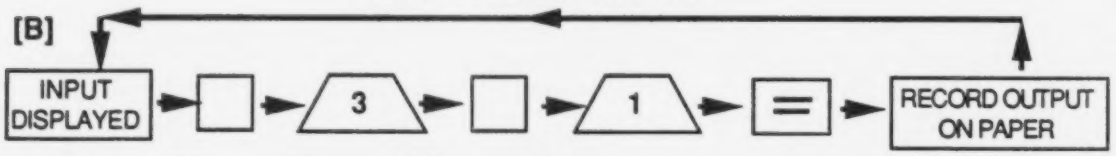
[A]



8 15 29 57 113 ____ ____ ____ ____

DO NOT CLEAR CALCULATOR

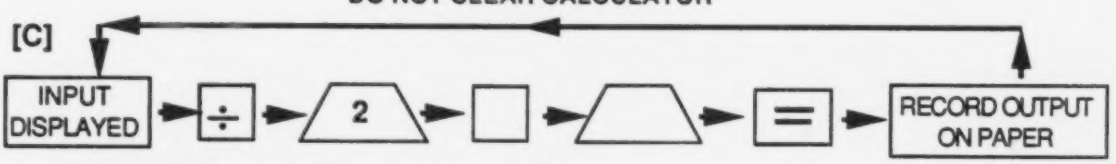
[B]



8 23 68 203 608 ____ ____ ____ ____

DO NOT CLEAR CALCULATOR

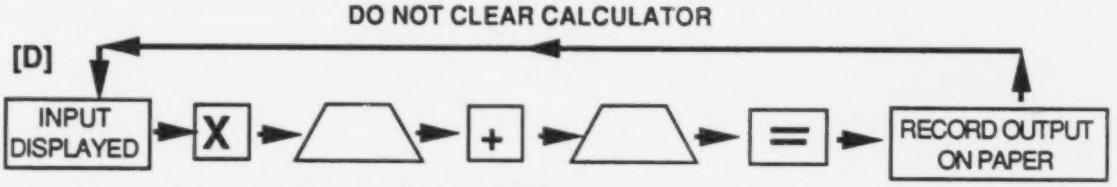
[C]



5378 2690 1346 674 338 ____ ____ ____ ____

DO NOT CLEAR CALCULATOR

[D]

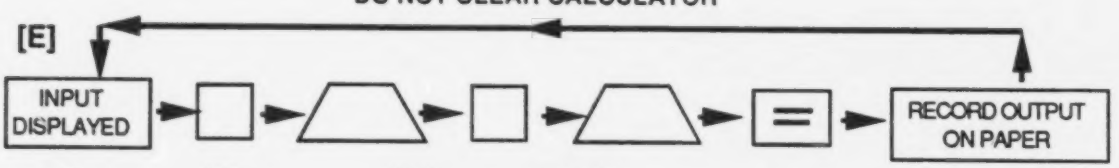


1 15 155 1555 15555 ____ ____ ____ ____

3 ____ ____ ____ ____ ____ ____ ____ ____

DO NOT CLEAR CALCULATOR

[E]



1 101 10101 1010101 ____ ____

3 301 ____ ____ ____ ____

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CHAPTER 1 ASSESSMENT:

PATTERNS AND FUNCTIONS

1. What is the highest power of 2 that will fit on your calculator display?

   Student response:
   26. $2^{26} = 67108864$ fits on the calculator display, 2^{27} does not. (This assumes use of a calculator with an 8 digit display.)

2. a. Which do you think is larger, 7^9 or 9^7? Estimate, then use the calculator.
   Student response: $7^9 = 40{,}353{,}607$ $9^7 = 4{,}782{,}696$ $7^9 > 9^7$

   b. Choose two different numbers for the base and power. Investigate, using your calculator, whether the smaller number as the base or the larger number as the base gives the greater answer. Record all results. Can you draw a conclusion?

   Student response should include examples showing that no conclusion can be reached. For example:

   $1^2 = 1$ is less than $2^1 = 2$
   $2^3 = 8$ is less than $3^2 = 9$
   $3^4 = 81$ is greater than $4^3 = 64$
   $4^5 = 1024$ is greater than $5^4 = 625$

3. Write the mathematical expressions that this calculator sequence will solve.

   5 x 1 = = = = = =

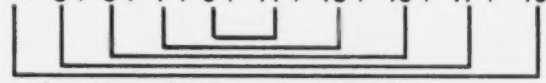
   Student response: 5^6 or 5 x 5 x 5 x 5 x 5 x 5

4. Solve the following problem in as many different ways as you can. Explain all of your solutions.
   1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 =

   Student response:
   a. 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 = 10^2 = 100 by patterns from CAMP-LA lessons Strange Sequences and Ancient Oddity.

   b. Pairs of numbers that have a sum of 20.

   1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 = 5 x 20 = 100 by adding pairs.

   of numbers that have a sum of 20.

   c. 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 = 100 by normal addition.

   d. Pairing of numbers to simplify addition can also be used.

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5. a. Choose 5 or more different 4-digit numbers. Complete the chart and answer question.

4-digit number	Number with digits reversed	Sum

b. What prime number is a divisor of every one of the sums?

a) Student response should include a completed chart similar to the one below.

4-digit number	Number with digits reversed	Sum
1234	4321	5555
7853	3587	11440
3579	9753	13332
9876	6789	16665
2468	8642	11110

b) Eleven divides all sums.

6. Explain the numbers that appear in a calculator display when you do the following. Record, after each press of the equal sign.

a. 75 + 58 = = = = =
b. 1020 - 72 = = = = =
c. 1024 ÷ 2 = = = = =
d. 23 x 57 = = = =

Student response:

a. 75 + 58 = = = = = 133, 191, 249, 307, 365
When "=" is first pressed the calculator computes 75 + 58. Each additional time "=" is pressed, the calculator adds 58 to the number in the display.

b. 1020 - 72 = = = = = 948, 876, 804, 732, 660
When "=" is first pressed the calculator computes 1020 - 72. Each additional time "=" is pressed, the calculator subtracts 72 from the number in the display.

c. 1024 ÷ 2 = = = = = 512, 256, 128, 64, 32
When "=" is first pressed the calculator computes 1024 ÷ 2. Each additional time "=" is pressed, the calculator divides the number in the display by 2.

d. 23 x 57 = = = = 1311, 30153, 693519, 15950937
When "=" is first pressed the calculator computes 23 x 57. Each additional time "=" is pressed, the calculator multiplies the number in the display by 23.

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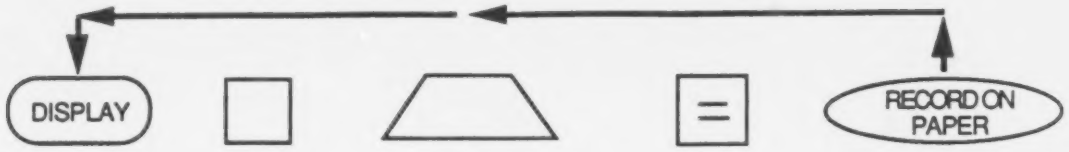
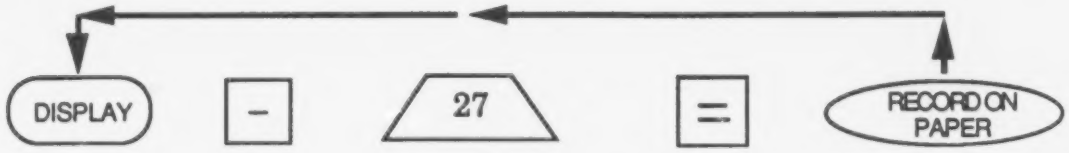
7. Fill in the missing flow chart items and continue the sequence.



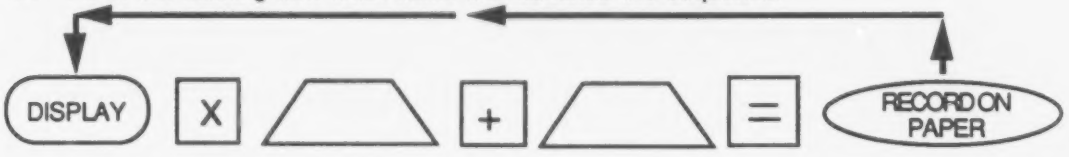
350 323 296 269 _____ _____ _____ _____ _____

Student response:



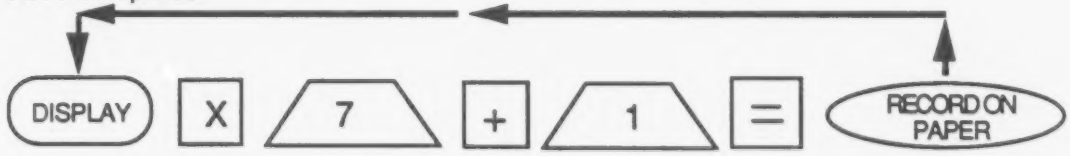
350 323 296 269 242 215 188 161 134

8. Fill in the missing flow chart items and continue the sequence.



1 8 57 400 _____ _____ _____ _____ _____

Student response:



1 8 57 400 2,801 19,608 137,257 960,800

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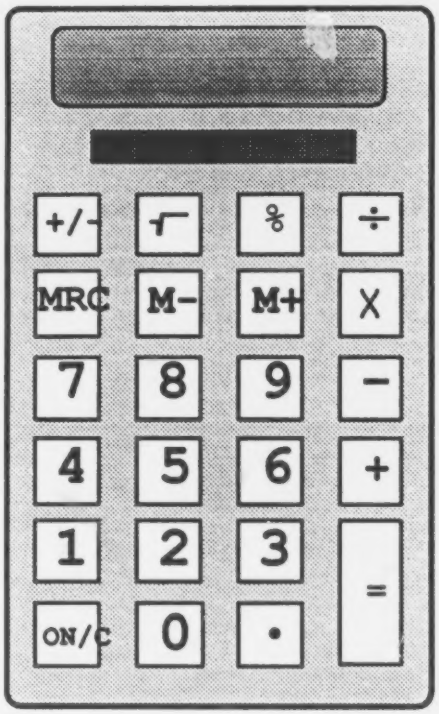
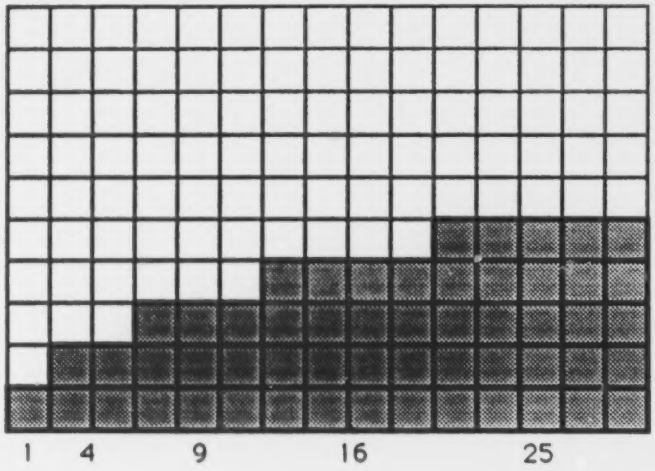
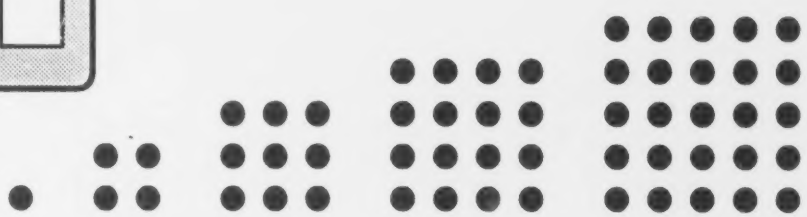
CAMP-LA

Calculators and Mathematics Project, Los Angeles







Grades 5 - 6

CHAPTER 2
LOGIC/ STATISTICS AND PROBABILITY

GOING TO THE MOVIES

GRADE: 5 - 6

STRAND: Logic

SKILL: Organize and interpret data.

MANAGEMENT

CLASS ORGANIZATION: Small group or pairs

TIME FRAME: One math period

MATERIALS: Calculator, overhead transparency

PREREQUISITE SKILL: Interpret data from a table

LESSON

- **DIRECTED INSTRUCTION:**

  Tell the class this story. **Some students from our school would like to take a field trip to the movies. Adults as well as children must attend. Adult tickets cost $5 and student tickets $3. Your job is to investigate what possible combinations of students and adults can attend if you must spend EXACTLY $300.** Use an overhead transparency of Student Activity Sheet 1.

  Ask, can these conditions be met if only 1 adult attends? Give them time to figure out that 1 adult ticket costing $5 would leave $295 for student tickets.

  The answer to 295 ÷ 3 is not a whole number, so you can't spend exactly $295 on $3 student tickets.

  There must be more than 1 adult. Ask, can there be exactly 2 adults? Give them time to work. Discuss that 2 adult tickets at $5 each leaves $290 for student tickets. 290 ÷ 3 is not a whole number so you can't spend exactly $290 on student tickets. There can't be 2 adults.
  Ask, can there be exactly 3 adults? Allow time for students to work, then discuss that 3 adult tickets cost $15. There is $285 left for student tickets. 285 ÷ 3 = 95, so 95 student tickets could be purchased. Hand out the Student Activity Sheet 1. Tell them that the chart has already been filled in for 3 adults on the trip.

- **GUIDED PRACTICE:**

  Ask students to see if there can be exactly 4, 5, 6 or more adults. Have them fill in successful solutions on their chart.
  Ask students to find as many solutions as possible. Suggest that they look at the successful solutions on their chart to see if they can detect any patterns that will assist them in finding additional solutions. After they have spent sufficient time finding solutions, hand out Student Activity Sheet 2.

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Number of Adult tickets	Total Cost of Adult tickets	Number of Student Tickets	Total Cost of Student Tickets	Total Cost of All tickets
→5X→		→3X→		
3	$15	95	$285	$300
6	$30	90	$270	$300
9	$45	85	$255	$300
12	$60	80	$240	$300
15	$75	75	$225	$300
18	$90	70	$210	$300
21	$105	65	$195	$300
24	$120	60	$180	$300
27	$135	55	$165	$300
30	$150	50	$150	$300
33	$165	45	$135	$300
36	$180	40	$120	$300
39	$195	35	$105	$300
42	$210	30	$90	$300
45	$225	25	$75	$300
48	$240	20	$60	$300
51	$255	15	$45	$300
54	$270	10	$30	$300
57	$285	5	$15	$300

Ask students what patterns they observe in the chart. They should notice that in this form the first column increases by 3, the second by 15, the third decreases by 5, the fourth decreases by 15. They might say, as the student numbers get larger, the adult numbers get smaller. Give credit to any true observations.

- **INDEPENDENT PRACTICE:**
  Have students or groups of students complete Student Activity Sheet 2. Discuss the results with the class.

- **EVALUATION:**
  Have students or groups of students develop a similar situation. Write a chart recording all possible solutions, then write a set of conditions which narrows the choices down to a single solution.

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GOING TO THE MOVIES
Student Activity Sheet 2
Teacher Answer Key

(Hand out only after Page 1 has been completed and discussed)

	Number of Adult tickets	Total Cost of Adult tickets	Number of Student Tickets	Total Cost of Student Tickets	Total Cost of All tickets
	→5X→		→3X→		
Z	3	$15	95	$285	$300
Z	6	$30	90	$270	$300
Z	9	$45	85	$255	$300
Z	12	$60	80	$240	$300
Z	15	$75	75	$225	$300
	18	$90	70	$210	$300
Y	21	$105	65	$195	$300
Y	24	$120	60	$180	$300
Y	27	$135	55	$165	$300
Y	30	$150	50	$150	$300
Y	33	$165	45	$135	$300
X	36	$180	40	$120	$300
X	39	$195	35	$105	$300
X	42	$210	30	$90	$300
X	45	$225	25	$75	$300
X	48	$240	20	$60	$300
X	51	$255	15	$45	$300
X	54	$270	10	$30	$300
X	57	$285	5	$15	$300

Use the data given below to eliminate possibilities from the chart.

1. There must be more students than adults. (Put an x in front of the rows for answers you must eliminate.)

2. The school must spend less than $100 on adult tickets. (Put a y in front of the rows for new answers you can eliminate.)

3. The bus holds only 89 passengers. (Put a z in front of the rows for new answers you can eliminate.)

4. How many adults and how many students are going on this trip.

   Adults 18 Students 70

5. Could you have arrived at his answer using only two clues above or were all three necessary? Only, clues 2 and 3 are needed.

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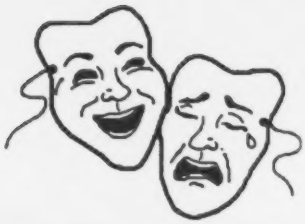
Name _____



GOING TO THE MOVIES
Student Activity Sheet 1

Number of Adult tickets	Total Cost of Adult tickets	Number of Student Tickets	Total Cost of Student Tickets	Total Cost of All tickets
→5X→		→3X→		
3	$15	95	$285	$300
				$300
				$300
				$300
				$300

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Name _____

GOING TO THE MOVIES
Student Activity Sheet 2

Number of Adult tickets	Total Cost of Adult tickets	Number of Student Tickets	Total Cost of Student Tickets	Total Cost of All tickets
→5X→		→3X→		
3	$15	95	$285	$300
6	$30	90	$270	$300
9	$45	85	$255	$300
12	$60	80	$240	$300
15	$75	75	$225	$300
18	$90	70	$210	$300
21	$105	65	$195	$300
24	$120	60	$180	$300
27	$135	55	$165	$300
30	$150	50	$150	$300
33	$165	45	$135	$300
36	$180	40	$120	$300
39	$195	35	$105	$300
42	$210	30	$90	$300
45	$225	25	$75	$300
48	$240	20	$60	$300
51	$255	15	$45	$300
54	$270	10	$30	$300
57	$285	5	$15	$300

Use the data given below to eliminate possibilities from the chart.

1. There must be more students than adults. (Put an **x** in front of the rows for answers you must eliminate.)

2. The school must spend less than $100 on adult tickets. (Put a **y** in front of the rows for new answers you can eliminate.)

3. The bus holds only 89 passengers. (Put a **z** in front of the rows for new answers you can eliminate.)

4. How many adults and how many students are going on this trip?

   Adults _____ Students _____

5. Could you have arrived at this answer using only two clues above or were all three necessary? _____

   _____

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NUMBER CLAIM

GRADE: 5 - 6

STRAND: Logic

SKILL: Practice computational operations +, -, x, ÷.

MANAGEMENT

CLASS ORGANIZATION: Small group

TIME FRAME: One math period

MATERIALS: Calculator

VOCABULARY: Digits, numeral, power, factorials

PREREQUISITE SKILL: Basic operations

LESSON

- **DIRECTED INSTRUCTION:**

You are presented with a 4-digit number. Using the operations +, -, x, ÷, and the 4 digits of the number, the goal of your team is to "claim" as many numbers as you can on the Solution Tally Sheet.

Rules:

1. Form a mathematical expression using all 4 of the digits given.
2. You may not use a digit more than once unless it is used in the given number more than once.
3. You may use the operational symbols as few or as many times as necessary.

Record Keeping:

1. Write down the solutions you created for the numbers you wish to claim.
2. Write your initials next to each solution on the Solution and Scoring Sheet.
3. Initial each square you claim on the Solution Tally Sheet.
4. After 15 minutes we will stop and evaluate team progress.

(Optional) Scoring:
Teams earn 5 points for each number claimed. Teams earn 5 bonus points for each number claimed that no other team has.

- **GUIDED PRACTICE:**

The 4-digit numeral used in examples 1-4 is 1498.

Example 1. Write the mathematical expression:
1 [+] 9 [+] 4 [+] 8 [=] 22 Verify the solution. Explain to students how they are to record this information.

Example 2. 1 [x] 9 [+] 4 [-] 8 [=] 5 Verify, record and initial.

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Example 3. 98 [-] 14 [=] 84 . Notice the same digits can be used to create 2 and 3 digit numerals.

Example 4. 8 [x] 9 [x] 4 [÷] 1 [=] 288 but that's not a number on the Solution Tally. Mental math and estimation lead to the conclusion that the answer would be too big for the chart.

Write down some other mathematical expressions and numbers generated. List solutions. (Allow 5-10 minutes and circulate to observe and assist.) Ask if there are any questions before handing out a Solution and Scoring Sheet and a Solution Tally Sheet to each team.

- **INDEPENDENT PRACTICE:**

  Hand out a Solution Tally Sheet and a Solution and Scoring Sheet to each team. Announce a four-digit numeral. You may wish to pick a date in history or the current year.

  Say, "Now work with other members of your group to claim as many numbers as you can in the next 15 to 30 minutes."

- **EVALUATION:**

  Call off numbers from the hundreds chart and have one student from each group verify the claim to that number (if using scoring option, have teams record scores).

  Cross off numerals on the overhead transparency as students cross them off on their team sheet.

  Ask people to share processes and strategies.

- **EXTENSION:**

  Have students make a list of numbers not claimed.

  Allow 10-15 minutes at the beginning of the next period to see if any additional solutions have been found.

  - Extension and/or Variations

    Teach $\sqrt{\ }$, powers and factorials. Continue the process allowing these new operational symbols.

    Examples: $\sqrt{16} = 4$ $\qquad 2^4 = 2 \cdot 2 \cdot 2 \cdot 2 = 16$

    $4! = 4 \cdot 3 \cdot 2 \cdot 1 = 24$ (read 4 factorial = 24)

  - Introduce INT function from computer programming: INT function takes any positive number and drops the decimal part.

    Examples: INT(8.75) = 8

    INT (3+2) = INT (1.5) = 1

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SOLUTION AND SCORING SHEET

PROBLEM	I	PTS	BONUS
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22	79		

PROBLEM	I	PTS	BONUS
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
44			

PROBLEM	I	PTS	BONUS
45			
46			
47			
48			
49			
50			
51			
52			
53			
54			
55			
56			
57			
58			
59			
60			
61			
62			
63			
64			
65			
66	80		

TEAM MEMBERS

TOTAL

SOLUTION AND SCORING SHEET

PROBLEM		PTS	BONUS	
67				
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				

81

PROBLEM		PTS	BONUS	
89				
90				
91				
92				
93				
94				
95				
96				
97				
98				
99				
100				

TEAM MEMBERS

TOTAL

82

SOLUTION TALLY SHEET

____ ____ ____ ____

given numeral

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

TEAM MEMBERS:

_____

_____

_____

_____

INITIAL EACH SQUARE AS YOU CLAIM IT.

I ♥ MATH

GRADE: 5 - 6

STRAND: Probability and Statistics

SKILL: Organize and interpret data.

MANAGEMENT:

CLASS ORGANIZATION: Individual

TIME FRAME: One math period

MATERIALS: Calculator

VOCABULARY: Heartbeat rate frequency, volume, flow rate, range, mode, mean, average

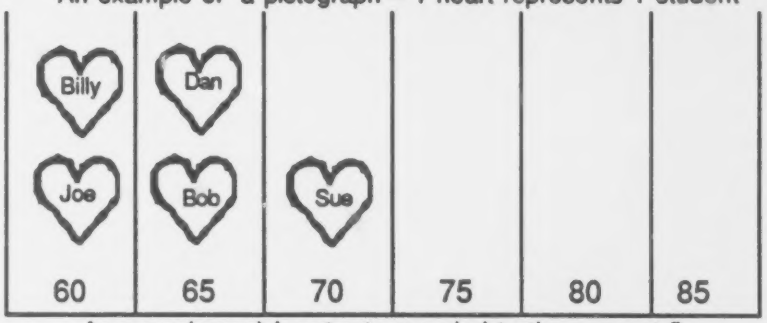
PREREQUISITE SKILL: Average (mean), range

LESSON

- **DIRECTED LESSON:**

  Hand out I ♥ MATH Student Activity Sheet 1.
  Students determine their heart rate by putting their index and middle fingers on their wrists, and counting the number of pulses that beat in one minute. Students record their results on the Student Activity Sheet 1 and average the results. Compile class data on average (mean) heart beat rate. Cut out heart shapes; have each student record his/her name and average heart beat rate. Make a pictograph of the results and discuss. Students may also determine the range, the mode, and the median of the number of heartbeats.

  An example of a pictograph – 1 heart represents 1 student



  Average (mean) heart rate rounded to the nearest five.

- **GUIDED PRACTICE:**

  Use a calculator to determine how many times your heart beats in one hour, one day, one year and one lifetime (assume 82 years).

  Students utilize data collected and complete Student Activity Sheet 1.

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- **INDEPENDENT PRACTICE:**

  Hand out Student Activity Sheet 2.
  Hearts beat at different rates depending on the amount of physical exertion. Due to the physical activities in which students will be engaged, this activity is done outdoors.

  Students complete their activity sheet. The range is computed by taking the highest rate and subtracting the lowest rate. Discuss results.

- **EXTENSION:**

  Use I ♥ MATH Student Activity Sheet 1.
  Data collected may be displayed in a graph. Is there a difference between the heart beat rates of boys and girls? Is height a factor in heart beat rates? Is there a difference in the rates if they are done in the morning or afternoon? If this is an on-going activity would there be a change in the heart beat rate from September to December? If so, why? Perhaps you can think of additional projects for your class.

- **HOME ACTIVITY:**

  Hand out I ♥ MATH Home Activity Sheet to be completed at home.

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Name_____

I ♥ MATH
Student Activity Sheet 1

Put your index and middle fingers on your wrist.

How many pulses in one minute?_____

Repeat five times, record results below

A._____ B._____ C._____ D._____ E._____

Use your calculator to find your heart beat rate:

- Find the total number of pulses [add results 1 through 5] Total _____

- Find the average (mean) by dividing the total by 5 Answer _____

This is your heart beat rate per minute. Use this rate to determine how many times your heart beats in:

1. One hour ___
2. One day ___
3. One year ___
4. 82 years ___

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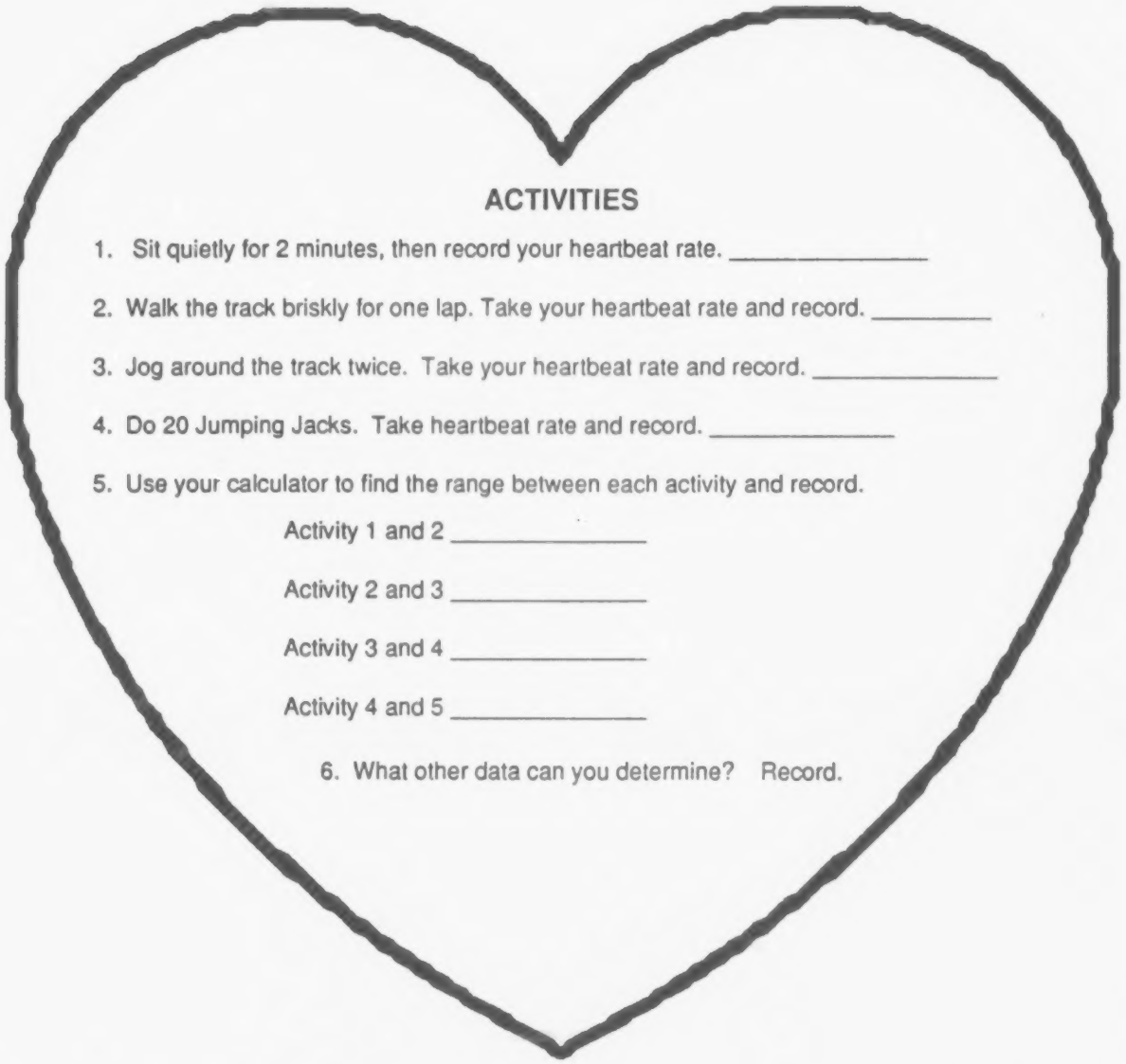
Name_____

I ♥ MATH
Student Activity Sheet 2



ACTIVITIES

1. Sit quietly for 2 minutes, then record your heartbeat rate. _____
2. Walk the track briskly for one lap. Take your heartbeat rate and record. _____
3. Jog around the track twice. Take your heartbeat rate and record. _____
4. Do 20 Jumping Jacks. Take heartbeat rate and record. _____
5. Use your calculator to find the range between each activity and record.

   Activity 1 and 2 _____

   Activity 2 and 3 _____

   Activity 3 and 4 _____

   Activity 4 and 5 _____

6. What other data can you determine? Record.

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Name _____

I ♥ MATH

Home Activity Sheet

Your heartbeat rate when you are asleep is about the same as when you sit very quietly for 5 minutes. How many times would your heart beat during $2\frac{1}{2}$ hours of sleep? _____

If you sleep $\frac{1}{3}$ of your life (assume 81 years) how many heartbeats will you have while you sleep? _____

Take the heartbeat rate for a member of your family and use your calculator to determine how many times the heart beats in:

1. One hour _____
2. One day _____
3. One year _____

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HOW FAST CAN YOU RUN?

GRADE: 5 - 6

STRAND: Probability and Statistics

SKILL: Find the average from a set of data.

MANAGEMENT:

CLASS ORGANIZATION: Small group

TIME FRAME: One or two math periods

MATERIALS: Calculator, stopwatch, 50-yard tape measure

VOCABULARY: Time, second, tenth of a second, rate

PREREQUISITE SKILL: Round to the nearest tenth, measure length, divide with decimals, use a stop watch, add decimals

LESSON

- **DIRECTED INSTRUCTION:**

1. Ask students how fast they think they can run 50 yards.
2. Use the school playground. Mark off a fifty yard strip.
3. Place a student at the starting point. Place a second student at the 50-yard point with a stop watch. The first student signals when a runner starts the 50-yard run. Read the stop watch to the nearest tenth of a second.
4. Have another student record the time of each runner. For example, ten readings may be as follows:

1st student	7.1 seconds	6th student	6.8 seconds
2nd student	7.3 seconds	7th student	7.2 seconds
3rd student	6.9 seconds	8th student	7.5 seconds
4th student	8.2 seconds	9th student	7.3 seconds
5th student	7.7 seconds	10th student	7.2 seconds

- **GUIDED PRACTICE:**

1. Show students that the speed of a runner in yards per second can be determined by dividing 50 yards by the time it takes the runner to travel 50 yards. We round the numbers to the nearest tenths. For example:

1st	50 ÷ 7.1 = 7.0422535	or 7.0 yards per second
2nd	50 ÷ 7.3 = 6.849315	or 6.8 yards per second
3rd	50 ÷ 6.9 = 7.2463768	or 7.2 yards per second
4th	50 ÷ 8.2 = 6.0975609	or 6.1 yards per second
5th	50 ÷ 7.7 = 6.4935064	or 6.5 yards per second
6th	50 ÷ 6.8 = 7.3529411	or 7.4 yards per second
7th	50 ÷ 7.2 = 6.9444444	or 6.9 yards per second
8th	50 ÷ 7.5 = 6.6666666	or 6.7 yards per second
9th	50 ÷ 7.3 = 6.849315	or 6.8 yards per second
10th	50 ÷ 7.2 = 6.9444444	or 6.9 yards per second

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2. Have students determine a formula for finding speed.

Speed is determined by dividing the distance, (50 yards), by the time it took to run the distance.

"S" represents speed. "t" represents time. "d" represent distance.

$$d \div t = S$$

50 yards ÷ 7.1 = 7.0 yards/second
In other words, the first student ran an average of 7.0 yards every second.

3. The average speed of all ten runners is:

Average speed (mean) = the sum of the ten students' speeds divided by the number of students.

$$\frac{7.0 + 6.8 + 7.2 + 6.1 + 6.5 + 7.4 + 6.9 + 6.7 + 6.8 + 6.9}{10}$$

4. Average speed rounds to 6.8 meters per second.

5. Discuss what units we use for how fast students run per second.

- **INDEPENDENT PRACTICE:**

  - Work in groups.
  - Record on the Student Activity Sheet the time it took each participating student to run 50 yards.
  - Compute the speed of each participating student.
  - Compute the average speed of each group.
  - Compute the average of group scores.

- **EXTENSION:**

  Compute a class average (mean) by using individual scores. Compare results with average of group scores. Discuss any differences.

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Name _____

_____

_____

_____

HOW FAST CAN YOU RUN?

Student Activity Sheet

1. COMPLETE THE TABLE FOR YOUR GROUP.

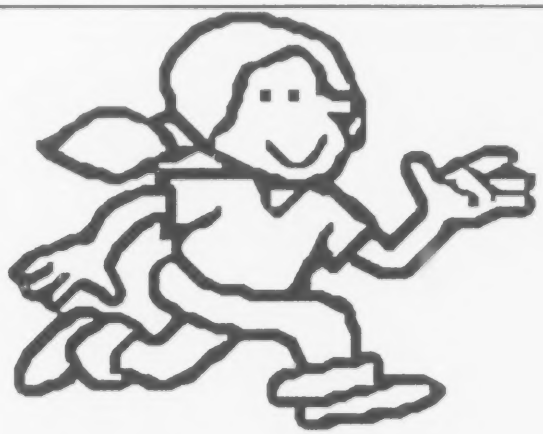
50 YARD RUN		
NAME	TIME(seconds)	SPEED (yards per second)

2. Compute the group average (mean). _____

_____

3. Obtain averages from each group. Compute an average (mean) of all of the groups.

_____



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M AND M AND M

GRADE: 5 - 6

STRAND: Probability and Statistics

SKILL: Determine the mean, median and mode from a set of data.

MANAGEMENT

CLASS ORGANIZATION: Individuals or groups

TIME FRAME: One or two math periods

MATERIALS: Calculator

VOCABULARY: Measures of central tendency: average, mean, median, mode

PREREQUISITE SKILL: Basic operations

LESSON

- **DIRECTED INSTRUCTION:**
  - Hand out Student Activity Sheet 1. Without further explanation, ask the class to look at the prices of the cars for sale and answer question 1. Discuss student answers to question 1.
  - Introduce the three different measures of central tendency: mean, median and mode. Work through part 1, problems 2-4 with the class, using the following information.
  - Discuss the fact that the median and mode are important measures of central tendency, even though the mean is most commonly used.
  - Use this formula to solve part 1, #2.

MEAN (average) Add the numbers. Divide this total by the number of addends.

(7495 + 7250 + 7250 + 9000 + 7995) ÷ 5 = $7798.

Note: Students can use the [M+] key to total the scores, then [MCR] ÷ 5 to find the mean.

Use this formula to solve part 1, #3.

MEDIAN - List the numbers in order from least to greatest or greatest to least. If there is an ODD number of addends, the median is the middle number in the list:

7250, 7250, [7495], 7995, 9000

The median is 7495.

If there is an even number of addends, add the two middle numbers and divide their sum by 2 to find the median:

(7250, 7250, [7495, 7995], 9000, 9050)

7495 + 7995 = 15,490

15,490 ÷ 2 = 7745

The median is 7745

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- Use this formula to solve part 1 #4.

MODE - Identify the number which occurs more often than any other number in the list.
(Sometimes there is no mode and sometimes there is more than one)
7250, 7250, 7495, 7995, 9000
The mode is 7250 because it occurs more often than any other number in the list.

- **GUIDED PRACTICE:**
  Have students complete parts 2 and 3 of Student Activity Sheet 1. Upon completion, discuss answers. Let students justify their choice on #4. Give credit to ALL logical responses. Discuss the effect of the Ferrari price on the mean.
  Note: the Ferrari not only raises the mean, but also distorts it to a point where the mean may not necessarily be the best number to describe the average.
  Discuss student observations in part 3.

- **INDEPENDENT PRACTICE:**
  Hand out Student Activity Sheet 2. Have students complete parts 1 and 2 and then discuss their answers with the class.

- **HOME ACTIVITY:**
  Hand out Student Activity Sheet 3 to be completed as homework. In order to complete the assignment, students must collect data for 1 week and compute the mean, median, and mode.
  An optional activity would be to compute the class or group mean, mode, or median from their data.

- **EXTENSION:**
  Additional ideas for extension activities:
  1. Graph all data from the Student Activity Sheets in this lesson.
  2. Use the almanac to find the population of states beginning with the letter "w". Compute the mean, median and mode.
  3. Use the almanac to find the population of states beginning with the same letter as your state. Compute the mean, median and mode.
  4. Ask students how they could use a calculator to find the mean for the data below since these numbers have too many digits to fit in a calculator display.

  14,000,000 : 11,500,000,000 : 13,200,000,000 : 730,000,000

  Let them attempt the problem and then explain to you how they handled the zeroes in order to enable them to use the calculator.
  For example: they may say they removed a certain number of zeros from the end of each number and replaced them later.

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M AND M AND M
Student Activity Sheet 1
Teacher Answer Sheet

Looking at the cost of used cars in the classified section of the newspaper, you find that the following 1983 cars are listed:

1983	Chrysler	$7495
1983	Ford Mustang	$7250
1983	Ford T-Bird	$7250
1983	Cadillac Sedan De Ville	$9000
1983	Volkswagon	$7995

Part 1

1. Based on this information, about how much would you say a 1983 car costs?
   Student answers will vary.
2. What is the mean (average) price of the cars? $7798
3. What is the median price of the cars? $7495
4. What is the mode price of the cars? $7250

Part 2

The next day you look at the paper and find that the Volkswagon advertisement is no longer there, it has been replaced by an advertisement for a 1983 Ferrari selling for $75,000. To compute the following measure of central tendency substitute the 1983 Ferrari Price for the 1983 Volkswagon price. (Hint, if you used the [M+] key to total the car prices, use the [M-] key to subtract the VW price, then [M+] key to add the Ferrari price.)

1. What is the new mean? $21,199
2. What is the new median? $7495
3. What is the new mode? $7250
4. Which measure of central tendency (mean, median, or mode) best describes the data in this example? Why?

Give credit to any response as long as it has a logical rationale.

Part 3

Compare your Part 1 and Part 2 answers. What do you observe? Why did this happen? The mean is higher but the median and mode remain the same. Give credit to any logical response.

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M AND M AND M
Student Activity Sheet 2
Teacher Answer Sheet

Part 1
Teachers often use some measure of central tendency to compute grades.

If your math scores were 5%, 5%, 90%, 91%, 92%, 92%, and 92%, then:

1) What is your mean score to the nearest %? 67%

2) What is your median score to the nearest %? 91%

3) What is your mode score to the nearest %? 92%

4) If the teacher's grading scale is given by: 90-100 A, 80-89 B, 70-79 C, 60-69 D, what grade would the teacher probably give you?

mean D
median A-
mode A

5) Which average best describes the data? Why?

Allow all responses that are given with a reasonable justification.

Part 2
Choose 5 numbers to fit the following situations:

A. The mean is larger than the mode or median.
Answers will vary: An example is 1, 1, 1, 1, 2.

B. The median is larger than the mean or mode.
Answers will vary: An example is 1, 1, 5, 6, 7.

C. The mode is larger than the median or mean.
Answers will vary: An example is 1, 2, 3, 9, 9.

96

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Name _____

M AND M AND M
Student Activity Sheet 1

Looking at the cost of used cars in the classified section of the newspaper, you find that the following 1983 cars are listed:

1983	Chrysler	$7495
1983	Ford Mustang	$7250
1983	Ford T-Bird	$7250
1983	Cadillac Sedan De Ville	$9000
1983	Volkswagon	$7995

Part 1

1. Based on this information, about how much would you say a 1983 car costs?

   _____

2. What is the mean (average) price of the cars? _____

3. What is the median price of the cars? _____

4. What is the mode price of the cars? _____

Part 2

The next day you look at the paper and find that the Volkswagon advertisement is no longer there. It has been replaced by an advertisement for a 1983 Ferrari selling for $75,000. To compute the following measure of central tendency substitute the 1983 Ferrari Price for the 1983 Volkswagon price. (Hint, if you used the [M+] key to total the car prices, use the [M-] key to subtract the VW price, then [M+] key to add the Ferrari price.)

1. What is the new mean? _____
2. What is the new median? _____
3. What is the new mode? _____

4. Which measure of central tendency (mean, median, or mode) best describes the data in this example? Why?

   _____

   _____

Part 3

Compare your Part 1 and Part 2 answers. What do you observe? Why did this happen?

_____

_____

_____

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Name _____

M AND M AND M
Student Activity Sheet 2

Part 1
Teachers often use averages to compute grades.
Each test was worth 100 points.
If your math scores were 5%, 5%, 90%, 91%, 92%, 92%, and 92% then:

1) What is your mean score to the nearest %?

2) What is your median score to the nearest %?

3) What is your mode score to the nearest %?

4) If the teacher's grading scale is given by: 90-100 A, 80-89 B, 70-79 C, 60-69 D, what grade would the teacher probably give you?

mean _____
median _____
mode _____

5) Which average best describes the data? Why?

_____

_____

_____

_____

Part 2

With the aide of your calculator:
Choose 5 numbers to fit the following situation:

A. The mean is larger than the mode or median. An example is 1, 1, 1, 1, 2.

_____ _____ _____ _____ _____

mean = _____ median = _____ mode = _____

B. The median is larger than the mean or mode. An example is 1, 1, 5, 6, 7.

_____ _____ _____ _____ _____

mean = _____ median = _____ mode = _____

C. The mode is larger than the median or mean. An example is 1, 2, 3, 9, 9.

_____ _____ _____ _____ _____

mean = _____ median = _____ mode = _____

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Name_____

M AND M AND M
Student Activity Sheet 3

Record the time spent eating breakfast, watching TV, and studying for 1 week.

Record in Minutes 1 hour = 60 minutes	SUN	MON	TUES	WED	THURS	FRI	SAT	TOTAL MIN.
Time Spent Eating Breakfast								
Time Spent Watching TV								
Time Spent Studying								

At the end of the week, compute and record the mean, median and mode for each row of data above, and record in the chart below.

	MEAN	MEDIAN	MODE
Time Spent Eating Breakfast			
Time Spent Watching Television			
Time Spent Studying			

If your mother asked you how many minutes a day you watch television, which would you choose to tell her, the mean, median or mode? _____ Why?_____

_____

If your teacher asked you how many minutes a day you study, which would you report, the mean, median or mode? _____Why?_____

_____

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LICENSE TO COUNT

GRADE: 5 - 6

STRAND: Probability and Statistics

SKILL: Investigate possible arrangements (permutations).

MANAGEMENT

CLASS ORGANIZATION: Individual or pairs

TIME FRAME: One math period

MATERIALS: Calculator, two sets of cards (0-9) for each pair of students

VOCABULARY: Digit, possible outcomes, permutations

PREREQUISITE SKILL: Basic operations

LESSON

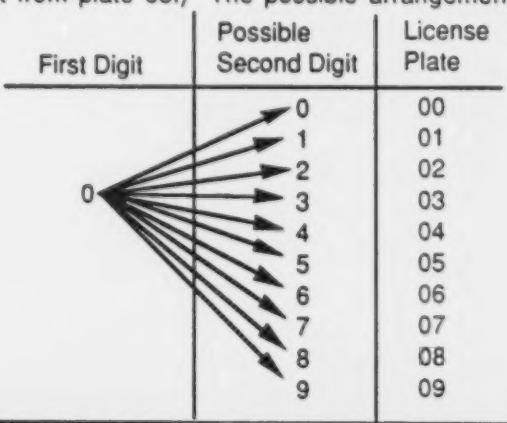
- **DIRECTED LESSON:**

  Discuss what can be found on license plates. How are they different? What is the purpose of a license plate?

- **DIRECTED ACTIVITY 1**

  1. Students work in pairs. Hand out two sets of cards 0-9, to each group. Students manipulate the cards to answer the following questions. If we made license arrangements using only one digit, how many plates are possible? Answer: Ten. 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.

  2. If we make license plates using two digits, how many arrangement are possible? (Here you need to discuss the matter of order: license plate 36 is different from plate 63.) The possible arrangements are as follows.



The different possible arrangements are called PERMUTATIONS.

CAMP-LA
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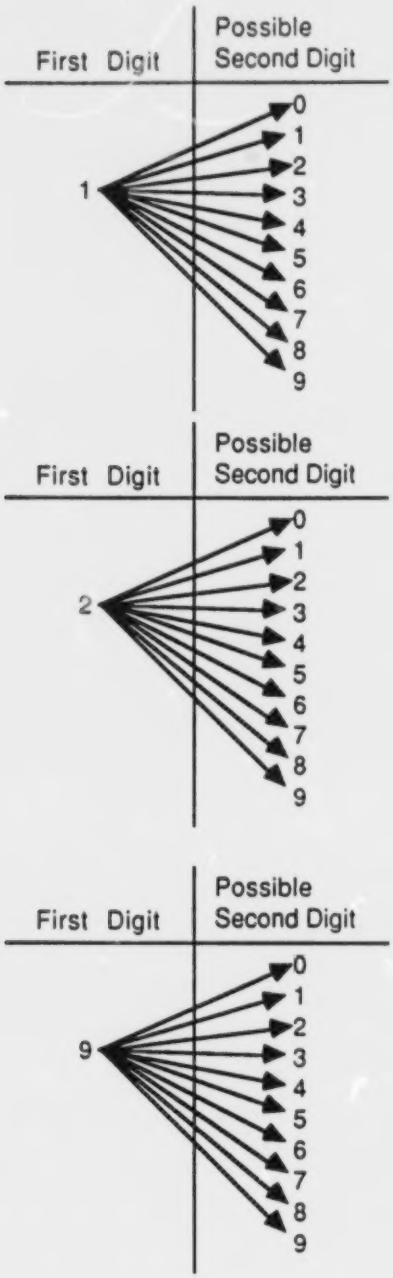

etc. . . .

Thus we have plates beginning with 00, 01, 02 . . . and ending with 95, 96, 97, 98, 99. There are 100 possible plates. Notice that this is represented by 10 choices for the first digit, times 10 choices for the second digit, for 10 x 10 = 100 possible plates.

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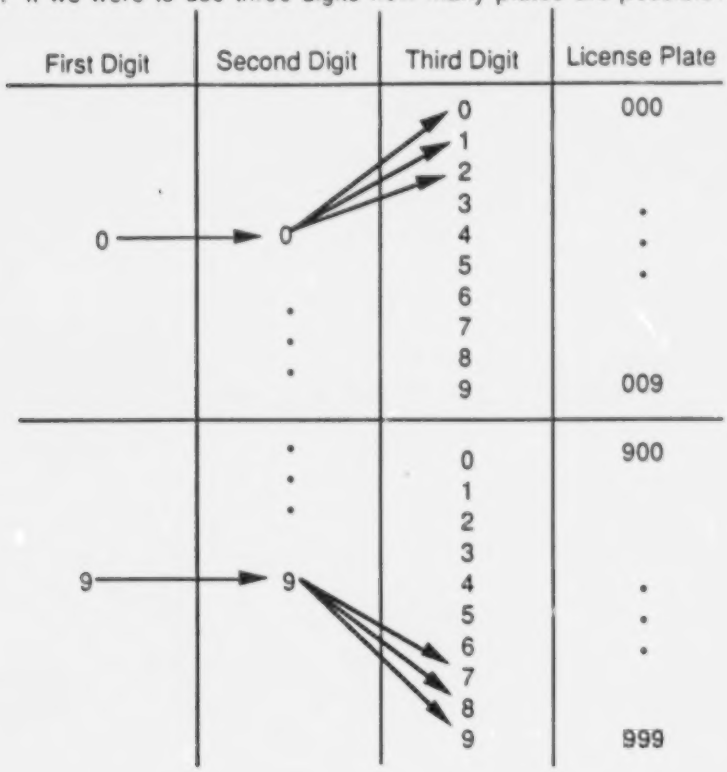
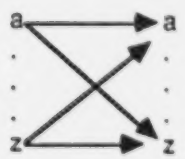
3. If we were to use three digits how many plates are possible?



Possible plates are 000, 001, 002, . . . 997, 998, 999 for a total of 1000. 10 choices for the first digit x 10 choices for the second digit x 10 choices for the third digit for 10 x 10 x 10 = 1000 possible plates.

4. What if we use letters of the alphabet instead of digits? If we use a single letter how many plates are possible? 26 arrangements.

5. If we use two letters, how many are possible?



26 choices for the 1st letter times 26 choices for the 2nd letter

26 x 26

6. If we use three letters, how many arrangement are possible?

(26 choices for the 1st letter times
26 choices for the 2nd letter times
26 choices for the 3rd letter)

26 x 26 x 26

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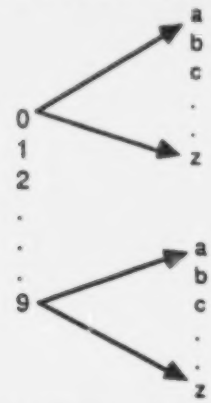
- **DIRECTED ACTIVITY 2**

1. You are now ready to combine numbers and letters. Suggest using 1 digit followed by 1 letter. How many arrangements are possible?



Answer: 10 x 26

2. How many arrangements are possible using 2 digits followed by 1 letter?
10 x 10 x 26

- **INDEPENDENT PRACTICE:**

Student Activity Sheet

Encourage students to use diagrams, if necessary, to understand the need to multiply.

- **HOME ACTIVITY:**

1. Use the same skills to find the number of phone numbers that are possible with seven digits. Can the number zero be used first? Why?

   Answer: Starting a phone number with zero will get the operator.
   9 x 10 x 10 x 10 x 10 x 10 x 10 = 9,000,000.

2. When you add three digits for an area code, how many phone numbers are possible? Be careful, note when you can and cannot use zero.

   Answer: Starting a phone number with zero will get the operator.
   9 x 10 x 10 x 9 x 10 x 10 x 10 x 10 x 10 x 10 =
   9 x 10 x 10 x 9,000,000 = 8,100,000,000.

   Note: you may wish to discuss other number combinations that can't be used such as starting a number with 411 or 911.

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LICENSE TO COUNT
Teacher Answer Sheet

How many license plates are possible using:

1) One letter followed by two digits?

D57	$26 \times 10^2 = 2600$
EXAMPLE	

2) Two letters followed by two digits?

BA33	$26^2 \times 10^2 = 67{,}600$
EXAMPLE	

3) Three letters followed by one digit?

	$26^3 \times 10 = 175{,}760$
EXAMPLE (YOU PROVIDE)	

4) Three letters followed by two digits?

	$26^3 \times 10^2 = 1{,}757{,}600$
EXAMPLE (YOU PROVIDE)	

5) Three letters followed by three digits?

	$26^3 \times 10^3 = 17{,}576.000$
EXAMPLE (YOU PROVIDE)	

6) One digit followed by three letters?

	$10 \times 26^3 = 175{,}760$
EXAMPLE (YOU PROVIDE)	

7) A six letter personalized license plate?

	26^6 = too large for calculator display.
EXAMPLE (YOU PROVIDE)	

8) A seven letter personalized license plate?

	26^7 = too large for calculator display.
EXAMPLE (YOU PROVIDE)	

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Name _____

LICENSE TO COUNT

Student Activity Sheet

How many license plates are possible using:

1) One letter followed by two digits?

D 5 7

EXAMPLE

_____

2) Two letters followed by two digits?

B A 3 3

EXAMPLE

_____

3) Three letters followed by one digit?

EXAMPLE (YOU PROVIDE)

_____

4) Three letters followed by two digits?

EXAMPLE (YOU PROVIDE)

_____

5) Three letters followed by three digits?

EXAMPLE (YOU PROVIDE)

_____

6) One digit followed by three letters?

EXAMPLE (YOU PROVIDE)

_____

7) A six letter personalized license plate?

EXAMPLE (YOU PROVIDE)

_____

8) A seven letter personalized license plate?

EXAMPLE (YOU PROVIDE)

_____

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WHAT'S IN THE BAG?

GRADE: 5 - 6

STRAND: Probability and Statistics

SKILL: Experiment to determine probabilities, estimate probabilities through repeated sampling, convert fractional probabilities to percent.

MANAGEMENT

CLASS ORGANIZATION: Pairs

TIME FRAME: One to four math periods

MATERIALS: Calculator, snack packs of M & M's (one for every two students), small plastic bags, overhead projector, overhead transparent chips (4 colors of varying amounts to total 20)

VOCABULARY: Probability, experimental probability, ratio, percent, P(yellow), relative frequency

PREREQUISITE SKILLS: Addition and subtraction of fractions, percent

LESSON

- **DIRECTED INSTRUCTION:**

1. Explain to students that $\boxed{\text{Probability} = \frac{\#\text{ of Favorable outcomes}}{\text{Total outcomes}}}$. This fraction can be changed to a percent by multiplying by 100.
   For example:

   a) What is the probability of a 200 year old person walking into the classroom? (answer 0 or 0%).

   b) What is the probability of the sun rising tomorrow? (answer: 1 or 100%)

   c) What is the probability that a coin will come up heads when flipped? (answer: $\frac{1}{2}$ or 50%)

2. Explain that probabilities range from 0 and 1 inclusive, and are expressed as a fraction, a decimal, or an equivalent percent.

   If you have transparent colored chips, do problems 3 and 4 as stated, otherwise do a similar demonstration.

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3. Display 17 transparent colored chips of 4 different colors in varying amounts. Put your 17 chips in a bag and ask, "If I reached into the bag with my eyes closed, what color do you think I would pick?" Record responses.

4. Use the overhead projector:

> Remind students: we compute the probability of picking a color from the bag by writing a fraction with the total number of chips as the denominator, and the number of chips of the chosen color as the numerator.

For example, if there were 4 red chips in the bag, the probability of picking red would then be 4 out of 17. This is a ratio. To convert this to a percent, divide the numerator by the denominator and multiply by 100. Demonstrate with the overhead calculator: (4 ÷ 17) x 100 = 23.5 % rounded to the nearest tenth. Do a few more examples.

5. Ask students if you picked a chip from the bag 10 times and replaced it after each pick, would red be picked 23.5% of the time?

6. Perform the experiment and record results. Discuss. Was the experimental probability (number of times red chip drawn ÷ 10) close to the predicted probability of $\frac{4}{17}$ or 23.5%? Will the results always come out the same?

7. Hold up a bag of M & M's and ask, "If I reach into this bag of M & M's, what color do you think I will pick? Is there a way that I could predict the color I will pick? What would I need to know before I could make such a prediction?"
(Hint: Students would need to know how many M & M's are in the bag, and what colors they are.)

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- **GUIDED PRACTICE:**

Hand out Student Activity Sheets

Tell students they will be experimenting with M & M's to determine probabilities. They predict information about the M & M's in their package including the number of each color, then they do experiments.

Distribute worksheets, M & M's, plastic bags and calculators. They are not to open the package of M & M's until after they record their estimates on their worksheet. When they open the package, they place the M & M's into the plastic bag to keep them clean. At the conclusion of the lesson, they will share the M & M's with their partner.

EXTENSION:

For each experiment we define:

$$\text{Relative Frequency} = \frac{\text{number of times a color is drawn}}{\text{number of draws}}$$

The Relative Frequency is a fraction that represents the actual results you get from an experiment, that is, the experimental probability.

Note: Student results will vary based on the composition of their bag of M & M's.

Students may find that the Relative Frequency (experimental probability) computed for a color is close to the mathematical probability found in the data table.

Discuss: The larger the sample, the greater the chance that these numbers are close.

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WHAT'S IN THE BAG?

Student Activity Sheet, page 1

Before you open your M & M package:

- In the 1st table below, fill in your estimate for the number of M & M's, most common color, and least common color within your package.
- In the 1st row of the **M & M Data Table**, record your estimate for the number of each color.

Enter predictions first.	Estimate	Actual
1. How many M & M's are in your package?		
2. What is the most common color?		
3. What is the least common color?		

Open your package of M & M's

- In the table above, fill in the actual count of M & M's most common color and least common color.
- Fill in the actual number of M & M's of each color in the **M & M Data Table** below.
- Use the formulas below to compute the mathematical probability of each color being picked at random from the bag. Record the information on the second line of the **M & M Data Table.**

MATHEMATICAL PROBABILITIES

$$\text{ratio} = \frac{\text{number of each color}}{\text{total in bag}} \qquad \% = \frac{\text{number of each color}}{\text{total in bag}} \times 100$$

M & M DATA TABLE

	GREEN			ORANGE			YELLOW			LT.BRN			DK.BRN			RED		
	#	P(green) Ratio	%	#	P(orange) Ratio	%	#	P(yellow) Ratio	%	#	P(lt. brn) Ratio	%	#	P(dk. brn) Ratio	%	#	P(red) Ratio	%
Estimate																		
Actual																		

The ratio and percents from the Data Table are the probabilities of picking a specific color of M & M from your bag.

If you reached into your bag of M & M's and picked one without looking, which color would you probably pick?_____ Why do you think so? Write your answer.

_____

From the Data Table what is the probability of picking this color? _____ (ratio) or _____ (percent)

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NAME_____

WHAT'S IN THE BAG?
Student Activity Sheet 2

EXPERIMENT #1

1. Pick an M & M from your bag without looking and record the color.
2. Replace the M & M and shake the bag.
3. Do this 10 times. Use tally marks to keep track of the number of times you pick yellow.
4. Total yellow picked = _____.
   As a fraction $\frac{\text{number of yellows picked}}{\text{number of draws}}$, this is _____.

Statisticians call this fraction the relative frequency for picking yellow.

You picked yellow _____ % of the time.

5. Is this close to the P(yellow) column from the data table? _____.

EXPERIMENT #2

Try the above experiment again. Be sure to replace the M & M after each pick.

1. Write the ratio (fraction) of times for yellow?_____
2. Percent of times yellow was picked? _____%
   Was this close to P(yellow)? _____
3. Was this result the same or different from EXPERIMENT #1? _____
   _____
   _____
4. If you do the same experiment again would you expect the same result?
   Explain: _____
   _____
   _____

EXPERIMENT #3

Choose a color for this experiment.

1. Color _____ Probability from the data table_____%
2. Tally the number of times you picked this color out of 10?_____
3. Percent of times picked? _____%
4. Were you close to the predicted probability? _____

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WHAT'S IN THE BAG?

Student Activity Sheet 3

EXPERIMENT #4

In this experiment determine how many times you pick a light brown or a dark brown out of 10 tries.

1. Take an M & M from the bag ten times. Be sure to replace the M & M after each pick. Tally your results. How many times did you pick a brown, light or dark, out of 10 tries? _____ This is _____% of the time.

2. To compute the probability of picking one color or another we add their probabilities. Use the probabilities from the data table.

P(light or dark brown) = $\frac{\text{_____}}{\text{(fraction)}} + \frac{\text{_____}}{\text{(fraction)}} = \frac{\text{_____}}{\text{(fraction)}} = \text{_____}\%$

Was your experimental probability close to this?_____

3. Use this method to compute the following probabilities:

P(yellow or dark brown) = $\frac{\text{_____}}{\text{(fraction)}} + \frac{\text{_____}}{\text{(fraction)}} = \frac{\text{_____}}{\text{(fraction)}} = \text{_____}\%$

P(orange or dark brown) = $\frac{\text{_____}}{\text{(fraction)}} + \frac{\text{_____}}{\text{(fraction)}} = \frac{\text{_____}}{\text{(fraction)}} = \text{_____}\%$

P(yellow or orange) = $\frac{\text{_____}}{\text{(fraction)}} + \frac{\text{_____}}{\text{(fraction)}} = \frac{\text{_____}}{\text{(fraction)}} = \text{_____}\%$

Were you surprised with your percentages? Why or why not? _____

_____

_____

_____

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Name_____

WHAT'S IN THE BAG?

Student Activity Sheet 4

EXPERIMENT #5

1. What if you did not want to pick a certain color? For example, you do not want to pick orange. How would you compute the probability of this happening?

To compute the probability of an event not happening, we subtract the probability that it **will** happen from the number 1.

2. What is the fractional probability of picking orange from the data table?

   _____

   Subtract from the number 1: 1 - ____ = ____ = _____%

3. Now pick an M & M 10 times without looking and record how many times you do <u>not</u> pick orange. Be sure to replace the M & M 's after each pick._____

   As a fraction this is _____. As a percent_____%

   Were you close to the predicted probability?_____

   Now compute the following probabilities of <u>not</u> picking a color.

   P(not yellow) 1 - ____ = ____ = _____%

   P(not green) 1 - ____ = ____ = _____%

   P(not dk. brown) 1 - ____ = ____ = _____%

   P(not lt. brown) 1 - ____ = ____ = _____%

   If you do the same experiment again would you expect the same result? Why or why not?_____

   _____

   _____

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CHAPTER 2 ASSESSMENT:

LOGIC/STATISTICS AND PROBABILITY

1. You are on a television game show. Your challenge is to pick exactly 19 bills that are worth a total of $500 from stacks of $20 bills and $50 bills. How many of each bill would you select?

   Explain how you arrived at your answer.

   Student response: 15 - $20 bills
   4 - $50 bills

   Students should use a chart or other organized method of solution.

2. 1492 — Columbus sailed the ocean blue. Make a number sentence that is true. Use the digits 1, 4, 9, 2 once and only once to equal the numbers 1 to 20. No other digits may be used. The four operation signs, x, -, +, and ÷, and also square root and exponents may be used as often as you wish.

   Student responses will vary. One solution for each number from 1 to 20 is shown.

$1 = (2-1) \times (\sqrt{9} - \sqrt{4})$	$11 = 9 + 4 - (2 \times 1)$
$2 = 9 - (1 + 4 + 2)$	$12 = 9 + 4 - 2 + 1$
$3 = \frac{9 - (4 + 2)}{1}$	$13 = 9 \times 2 - (4 + 1)$
$4 = (9 - 2) - (4 - 1)$	$14 = (9 \times 2) - (4 \times 1)$
$5 = 24 - 19$	$15 = 29 - 14$
$6 = (4 + 2) \times 1 \times \sqrt{9}$	$16 = 9 + 4 + 2 + 1$
$7 = \frac{1 + 4 + 9}{2}$	$17 = (4 \times 2) + (9 \times 1)$
$8 = 9 - (4 + 2) + 1$	$18 = 4 \times 2 + 9 + 1$
$9 = \frac{1 + 9}{2} + 4$	$19 = 4 \times 9 \div 2 + 1$
$10 = (9 - 4) \times 2 \times 1$	$20 = 9 \times 2 \times 1 + \sqrt{4}$

3. a. Record your number of breaths for one minute. Repeat four more times. Use your calculator to find your average resting breath rate.

   b. Do 20 jumping jacks. Record your number of breaths for one minute. Repeat this process two more times then find your average (mean) breath rate. How does this average differ from your resting breath rate?

   Student responses will vary. The average rate after jumping jacks should be higher then the average resting breath rate. Evaluate for correct computation of mean (average).

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4. This week your class is publishing a newspaper. You were assigned the role of weather person. Your task is to measure and record the weather three times a day for five days. Your record of the morning, noon, and night temperatures are on the chart below. How would you report the temperature? Would you use mean, median, mode, or your own method of finding an average? Does your answer accurately describe the weather? Should you use all the data? Discuss how you arrived at your conclusions.

Temperature Readings in Degrees Fahrenheit

	Day 1	Day 2	Day 3	Day 4	Day 5
7:00 am	57	59	61	61	72
12:00 noon	70	72	71	73	92
7:00 pm	62	61	60	59	75

Student responses will vary. If all data are used, the median is 62. (62 is the number in the middle when all data are listed from smallest to largest.) The mode is 61 because it occurs most often. The mean is 67 because 1005 ÷ 15 = 67. Students may feel it is best to use only one time of day. They may question the appropriateness of the times of the day that were chosen.

5. Write a problem that requires collecting data and the use of mean, median, and mode.

Student responses may vary.

6. CAMP-LA Ice Cream store has 37 different flavors to offer. Discuss how many different ways you can make a two-scoop ice cream cone. Chocolate on top of vanilla is considered different than vanilla on top of chocolate.

Student response: 1369. There are 37 choices for the first scoop and 37 choices for the second scoop. There are 37 x 37 = 1369 total possibilities.

7. You have a bag with 6 blue, 5 red, and 4 yellow marbles. Experiment to find the probability of picking a red marble from the bag. The marble is replaced each time it is picked. Perform the experiment, organize and record the data. Compare your experimental results with the theoretical probability. Explain your results.

Student responses for experimental results will vary. The theoretical probability is that red will be picked $\frac{5}{15} = \frac{1}{3}$ or $33\frac{1}{3}$ % of the time.

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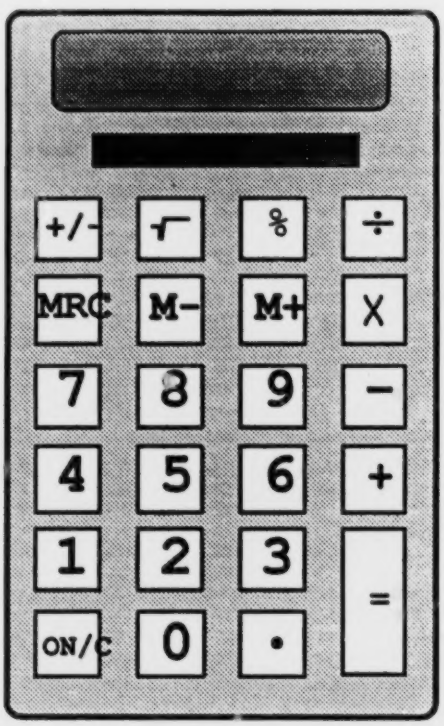
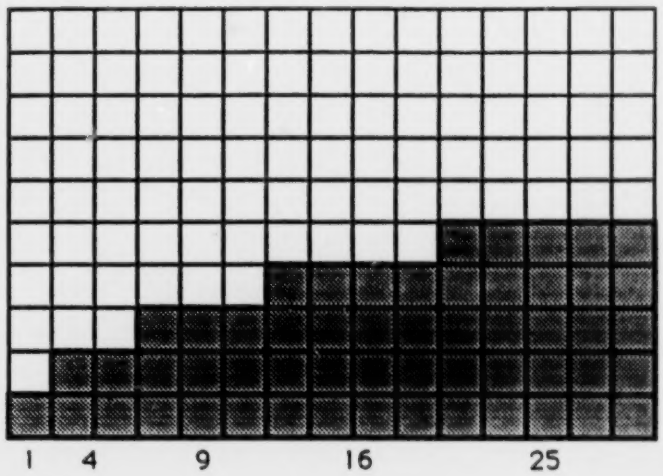
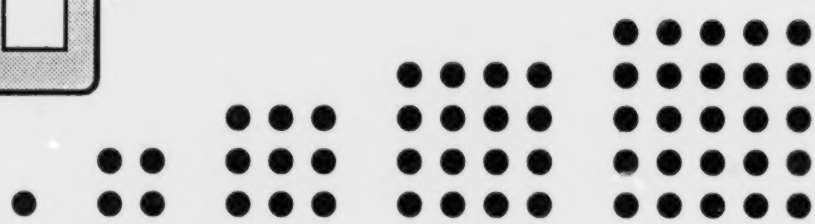
CAMP-LA

Calculators and Mathematics Project, Los Angeles







Grades 5 - 6

CHAPTER 3
MEASUREMENT/ GEOMETRY

COIN CAPERS

GRADE: 5 - 6

STRAND: Measurement

SKILL: Estimate and measure length in non-standard, metric, and customary units.

MANAGEMENT

CLASS ORGANIZATION: Whole class, small groups

TIME FRAME: One or two math periods

MATERIALS: Calculators, meter sticks, and centimeter rulers
Coins: quarters, dimes, and nickels (cut-out or play money), Student Activity Sheet 1 for every 2 students, Student Activity Sheet 2 for every 4 students

VOCABULARY: Millimeter, centimeter, meter, kilometer, cubit

PREREQUISITE SKILLS: Non-standard and metric measurement, averages, decimals, and rounding to hundredths place

LESSON

- **DIRECTED INSTRUCTION**

  Ask students to estimate answers for the following questions:

  If you were to do a standing broad jump and use a quarter (25¢ piece) as a unit of measure, how many quarters would you need to measure the jump? What is their total value?

  How many dimes would you need to measure the jump? What is their total value?

  Distribute Student Activity Sheet 1, discuss the chart at the top, and read questions 1-4. Work problems 1-4 together.

- **GUIDED PRACTICE:**

  Direct the students to work with their partners to discuss and solve questions 5 to 8.

- **INDEPENDENT PRACTICE:**

  Direct the students to work together in groups of four. They will read, discuss and answer the questions on Student Activity Sheet 2. They will need to have a space on the school yard to complete the broad jump portion of the Activity Sheet.

  Have each student do a standing broad jump, measure with a meter stick, and decide how much the jump would be worth in dimes, nickels, and quarters. (See Student Activity Sheet 2.)

- **EXTENSION:**

  Repeat the activities in customary units of measurement (inch, foot, yard and mile).

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COIN CAPERS
Student Activity Sheet 1
Teacher Answer Sheet

Coin	Dime	Nickel	Quarter
Approximate Diameter	1.8 cm	2.1 cm	2.4 cm

Record your estimate, then use your calculator to compute the answer.

1. If the diameter of a quarter is 2.4 cm, then how long is a line that is worth one dollar in quarters? 9.6 cm
2. If you place $10.00 worth of quarters end to end, how many centimeters long is the line? 96 cm
3. How many quarters would it take to make approximately 1 meter?
   100 ÷ 2.4 cm ≈ 41.666666 ≈ 42 quarters
4. If you placed twenty-five dollars worth of quarters in a straight line, how many centimeters long is the line? 240 cm
5. How much money would each of the following be worth?
   A meter's worth of:

Coin	Number of Coins	Value
Dime	56	$5.60
Nickel	48	$2.40
Quarter	42	$10.50

Answers will vary for problems 6 to 8:

6. Measure the length of your hand span in centimeters.
   What is your span worth in dimes? _____ nickels? _____
   quarters? _____. Compare with your classmates.
7. Measure the length of your foot in centimeters. What is your foot worth in dimes? _____ nickels? _____ quarters? _____
8. The distance from your longest fingertip to your elbow is called a cubit.
   What is your cubit worth in dimes?_____ nickels? _____
   quarters? _____. Compare with your classmates.

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Names _____

_____

COIN CAPERS

Student Activity Sheet 1

Coin	Dime	Nickel	Quarter
Approximate Diameter	1.8 cm	2.1 cm	2.4 cm

Record your estimate, then use your calculator to compute the answer.

1. If the diameter of a quarter is 2.4 cm, then how long is a line that is worth one dollar in quarters? _____ _____
   estimate answer

2. If you place $10.00 worth of quarters end to end, how many centimeters long is the line? _____ _____
   estimate answer

3. How many more quarters would it take to make approximately 1 meter?
   _____ _____
   estimate answer

4. If you placed twenty-five dollars worth of quarters in a straight line, how many centimeters long is the line? _____ _____
   estimate answer

5. How much money would each of the following be worth?
   A meter's worth of:

Coin	Number of coins	Value
Dime		
Nickel		
Quarter		

6. Measure the length of your hand span in centimeters. _____
   What is your span worth in dimes? _____ nickels? _____
   quarters? _____. Compare with your classmates.

7. Measure the length of your foot in centimeters. _____ What is your foot length worth in dimes? _____ nickels? _____
   quarters? _____

8. The distance from your longest fingertip to your elbow is called a cubit.
   What is your cubit worth in dimes? _____
   nickels? _____ quarters? _____ Compare with your classmates.

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Names_____ _____

_____ _____

COIN CAPERS

Student Activity Sheet 2

km	m	cm	mm
1,000 m	1m	0.01 m	0.001 m

Work in 4-member teams. You will need a meter stick, pencil, tally sheet, and calculator.

1. Each student does a broad jump.
2. Measure the length of each broad jump from the starting line to the heel mark.
3. Record distances jumped on the tally sheet.
4. Use the calculator to determine the number of coins and value of the jump in quarters, nickels, and dimes.
5. Complete the chart below based upon your broad jump. Find the average for each column. After completing the chart and question 6 below, discuss your findings with the other groups.

Coin	Dime	Nickel	Quarter
Diameter	1.8 cm	2.1 cm	2.4 cm

TALLY SHEET

Name	Distance Jumped	Number of Quarters	Value of Quarters	Number of Nickels	Value of Nickels	Number of Dimes	Value of Dimes
1. 2. 3. 4.							
Average							

6. Which coin gave your jump the greatest value? _____ Which coin gave your jump the least value? _____.

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HOW MUCH MONEY WILL I HAVE?

GRADE: 5 - 6

STRAND: Measurement

SKILL: Convert money to different currencies

MANAGEMENT

CLASS ORGANIZATION: Whole class, pairs

TIME FRAME: One math period

MATERIALS: Calculator

VOCABULARY: Currency, exchange rate, monetary units

PREREQUISITE SKILL: Understand the concept of decimals

LESSON

- **DIRECTED INSTRUCTION:**

  Hand out Student Activity Sheet. Tell students to look at the exchange rate chart. Ask, "If I take $50 to the bank and ask them to exchange it for Italian lira, how many lira will they give me?" Ask, "What answer do you get and how did you get it?" Listen for the correct answer. If it is not mentioned by students, lead them to the formula:

  American Dollars x Exchange Rate = The Foreign Currency Equivalent

  $50 x 1,176 lira/dollar = 58,800 Lira

- **GUIDED PRACTICE:**

  Ask, "If I take $50 to the bank and ask them to exchange it for British pounds, how many pounds will they give me?"

  Check to see that they compute
  $50 x .55 pounds/dollar = 27.5 British pounds

- **INDEPENDENT PRACTICE:**

  Students complete the Student Activity Sheet.

- **HOME ACTIVITY:**

  Cut out an advertisement from the newspaper. Choose a country and convert all the prices in the advertisement into the equivalent monetary amounts for that country.

  Note: For update of foreign exchange rates check a metropolitan newspaper Sunday Travel Section or the daily Financial Section.

  - You may wish to incorporate this lesson with your social studies unit.

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HOW MUCH MONEY WILL I HAVE?

Teacher Answer Sheet

Foreign Exchange Rates

Country	Foreign Currency for $1
Argentina (austral)	4.55
Australia (dollar)	1.30
Austria (schilling)	11.22
Belgium (franc)	33.44
Brazil (cruzado)	93.46
Britain (pound)	.55
Canada (dollar)	1.21
Chile (peso)	207.04
Colombia (peso)	207.04
Denmark (krone)	6.11
Ecuador (sucre)	286.53
Egypt (pound)	1.97
Finland (mark)	3.74
France (franc)	5.41
Greece (drachma)	121.08
Holland (guilder)	1.83
Hong Kong (dollar)	7.34
India (rupee)	13.16
Indonesia (rupiah)	1,336.00
Ireland (pound)	.61
Israel (shekel)	1.49
Italy (lira)	1,176.00
Japan (yen)	124.81
Jordan (dinar)	.31
Mexico (peso)	2,164.00
New Zealand (dollar)	1.38
Norway (kroner)	6.01
Philippines (peso)	20.00
Portugal (escudo)	123.46
Saudi Arabia (riyal)	3.40
Singapore (dollar)	1.86
South Africa (rand)	1.95
South Korea (won)	699.30
Spain (peseta)	106.43
Sweden (kroner)	5.67
Switzerland (franc)	1.34
Tahiti (franc)	97.09
Taiwan (dollar)	25.97
Turkey (lira)	1,069.00
Venezuela (bolivar)	24.24
W. Germany (mark)	1.62
Yugoslavia (dinar)	1,094.00

All quotes of March 2, 1988

You can use an Exchange Rate Chart to find the amount of a country's money that you will receive for each American dollar exchanged.

1(a). In which country would you receive the most monetary units in exchange for one American dollar? **Mexico**

(b). How much money would you receive when you exchange $900 into that country's money? **1,947,600 pesos**

2(a). In which country would you receive the least amount of monetary units in exchange for one American dollar? **Jordan**

(b). How much money would you receive when you exchange $900 for that country's money? **279 dinars**

3(a). In which country would you receive an amount of monetary units that is closest to your original amount? **Canada**

(b). How much would you receive when you exchange $900 for that country's money? **1089 dollars**

4. Choose 3 countries you would like to visit and compute how much money you would receive in their currency when you exchange $900.

Country	Foreign Currency
Answers will vary	

5. How can you tell which countries will give you more currency than your original number of dollars?
When the chart shows a number more than 1.

6. How can you tell which countries will give you less currency than your original number of dollars?
When the chart shows a number less than 1.

7(a). What is your current allowance? _____
(If you don't get an allowance, pretend you do and write in a reasonable amount.)

(b). How much would this allowance be: Answers will vary

in Mexican pesos? _____

in Ecuadoran sucres? _____

in British pounds? _____

8. If somebody gave you a gift of 86,560 Mexican pesos, how much would you receive if you converted it back into American dollars? $40
What operation did you use to compute your answer?
Division

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Name _____

HOW MUCH MONEY WILL I HAVE?

Student Activity Sheet

Foreign Exchange Rates

Country	Foreign Currency for $1
Argentina (austral)	4.55
Australia (dollar)	1.30
Austria (schilling)	11.22
Belgium (franc)	33.44
Brazil (cruzado)	93.46
Britain (pound)	.55
Canada (dollar)	1.21
Chile (peso)	207.04
Colombia (peso)	207.04
Denmark (krone)	6.11
Ecuador (sucre)	286.53
Egypt (pound)	1.97
Finland (mark)	3.74
France (franc)	5.41
Greece (drachma)	121.08
Holland (guilder)	1.83
Hong Kong (dollar)	7.34
India (rupee)	13.16
Indonesia (rupiah)	1,336.00
Ireland (pound)	.61
Israel (shekel)	1.49
Italy (lira)	1,176.00
Japan (yen)	124.81
Jordan (dinar)	.31
Mexico (peso)	2,164.00
New Zealand (dollar)	1.38
Norway (kroner)	6.01
Philippines (peso)	20.00
Portugal (escudo)	123.46
Saudi Arabia (riyal)	3.40
Singapore (dollar)	1.86
South Africa (rand)	1.95
South Korea (won)	699.30
Spain (peseta)	106.43
Sweden (kroner)	5.67
Switzerland (franc)	1.34
Tahiti (franc)	97.09
Taiwan (dollar)	25.97
Turkey (lira)	1,069.00
Venezuela (bolivar)	24.24
W. Germany (mark)	1.62
Yugoslavia (dinar)	1,094.00

All quotes of March 2, 1988

You can use an Exchange Rate Chart to find the amount of a country's money that you will receive for each American dollar exchanged.

1(a). In which country would you receive the most monetary units in exchange for one American dollar?_____

(b). How much money would you receive when you exchange $900 into that country's money? _____

2(a). In which country would you receive the least amount of monetary units in exchange for one American dollar?

_____

(b). How much money would you receive when you exchange $900 for that country's money? _____

3(a). In which country would you receive an amount of monetary units that is closest to your original amount? _____

(b). How much would you receive when you exchange $900 for that country's money? _____

4. Choose 3 countries you would like to visit and compute how much money you would receive in their currency when you exchange $900.

Country	Foreign Currency
_____	_____
_____	_____
_____	_____

5. How can you tell which countries will give you more currency than your original number of dollars?

_____

6. How can you tell which countries will give you less currency than your original number of dollars?

_____

7(a). What is your current allowance? _____
(If you don't get an allowance, pretend you do and write in a reasonable amount.)

(b). How much would this allowance be

in Mexican pesos? _____

in Ecuadoran sucres? _____

in British pounds? _____

8. If somebody gave you a gift of 86,560 Mexican pesos, how much would you receive if you converted it back into American dollars?_____
What operation did you use to compute your answer?

_____

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I HAVE, WHO HAS?

GRADE: 5 - 6

STRAND: Geometry

SKILL: Identify geometric shapes, find perimeters.

MANAGEMENT

CLASS ORGANIZATION: Whole class

TIME FRAME: One math period

MATERIALS: Calculator, transparency for directed lesson "I Have, Who Has?" Master for game cards (cut prior to lesson)

VOCABULARY: Perimeter, regular polygon, square, rhombus, rectangle, parallelogram, trapezoid, quadrilateral, regular pentagon, regular hexagon, regular octagon, regular decagon

PREREQUISITE SKILL: Find perimeter, differentiate between polygons

LESSON

- **DIRECTED INSTRUCTION:**
  - (Use transparency of Polygons) Review vocabulary and characteristics of the following polygons: pentagon, hexagon, octagon, decagon, rhombus, parallelogram and triangle (scalene, isosceles and equilateral.) Students can draw their own shapes to practice vocabulary use of names of polygons.
  - Students practice finding perimeters, and finding the length of an unknown side when the perimeter is given.

- **GUIDED PRACTICE:**
  1. Shuffle all cards. Hand out the entire set of 36 "I Have, Who Has?" game cards. Some students may have more than 1 card.
  2. Choose a student to start the game by reading the "Who has?" question on the game card. Example: Who has the perimeter of a regular hexagon whose sides measure 4.8 units?
  3. All students compute the answer using mental math or their calculator.
  4. If no one computes the perimeter correctly, assist the student who asked the question to give some hints as to the characteristics of a regular hexagon so they can successfully compute the perimeter.
  5. The student who has the card with the correct answer reads the entire card. "I have 28.8 units. Who has the length of a rectangle with a perimeter of 8.3 units and a width of 1.7 units?"

- **INDEPENDENT PRACTICE:**

  Continue the game until all cards are read. The student who was chosen to start will be the last to speak and will read the "I Have " statement only.

  Options - Choose a student to use a stopwatch to time the game. Trade cards and do the

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same game a second time using another student to begin.

Another option would be to cut the cards into 2 parts - one containing the "I Have" and one containing the "Who Has?" Give each student 1 of each. Students will be motivated to improve their previous response time and will become faster problem solvers.

Caution - Teacher needs to follow along on Teacher Master Sheet to make sure correct answers are being given and to prompt when necessary. The responses are in order.

- **EVALUATION:**
  - Successful completion of the "I Have, Who Has" game.

- **HOME ACTIVITY:**
  Each student writes a five question "I Have, Who Has?" game.

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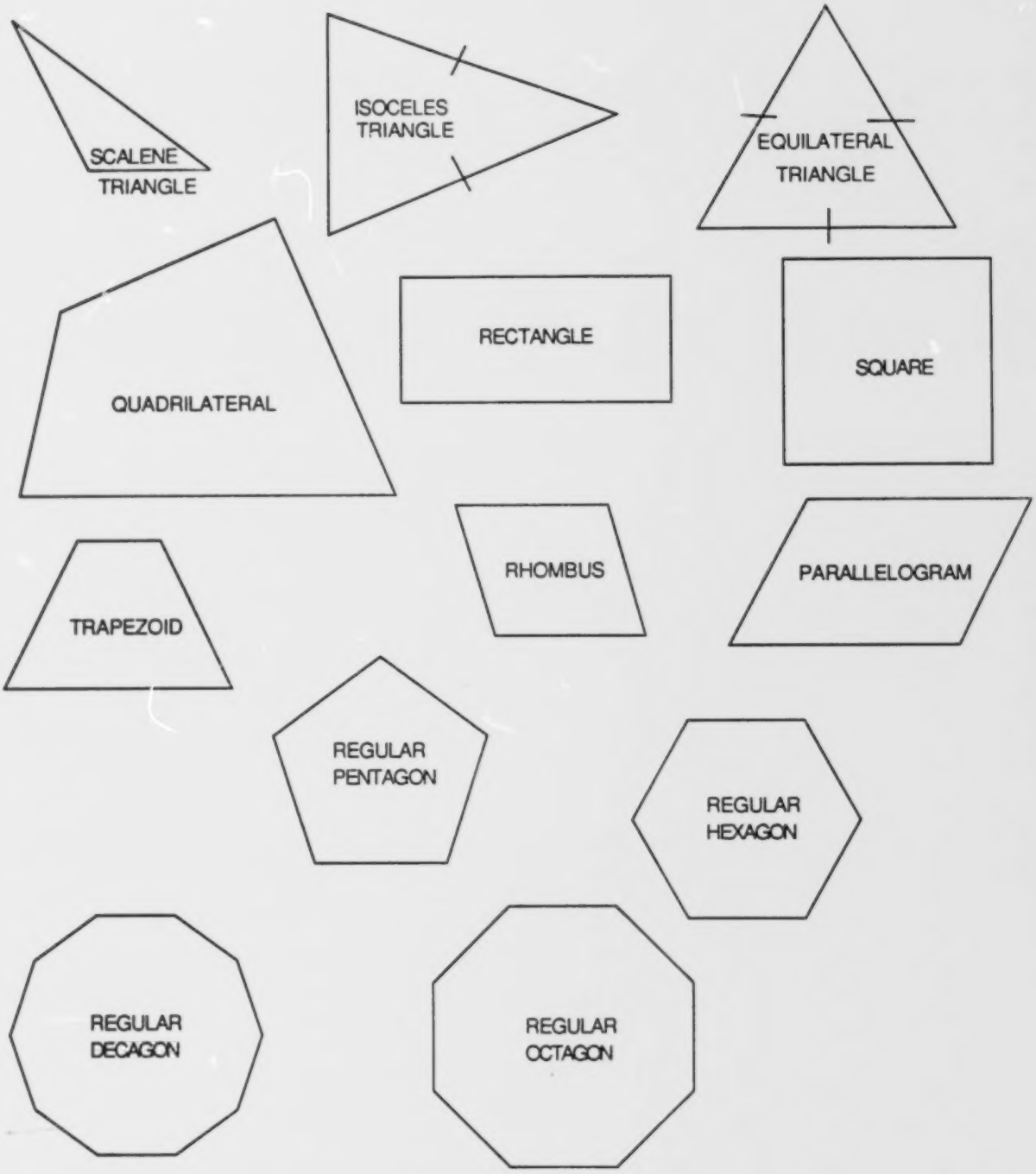
I HAVE, WHO HAS?
Transparency



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I HAVE, WHO HAS?
Teacher Master Copy

I have 34 units.
Who has the perimeter of a square whose sides measure 4.1 units?

I have 16.4 units.
Who has the perimeter of a equilateral triangle whose sides measure 3.5 units?

I have 10.5 units.
Who has the perimeter of a rectangle with a width of 2.8 units and a length of 4.9 units?

I have 15.4 units.
Who has the perimeter of a regular octagon whose sides measure 2.25 units?

I have 18 units.
Who has the perimeter of a regular hexagon whose sides measure 3.8 units?

I have 22.8 units.
Who has the perimeter of a rectangle with a length of 13.6 units and a width of 2.75 units?

I have 32.7 units.
Who has the perimeter of a rhombus whose sides measure 5.125 units?

I have 20.5 units.
Who has the perimeter of a quadrilateral whose sides measure 10, 9.4, 6.7, and 8.8 units?

I have 34.9 units.
Who has the perimeter of an isosceles triangle two of whose sides measure 7.65 units and whose third side measures 1.7 units?

I have 17 units.
Who has the perimeter of a rectangle with a width of 5 units and a length of twice the width?

I have 30 units.
Who has the perimeter of a scalene triangle whose sides measure 1.5, 2, and 2.5 units?

I have 6 units.
Who has the length of a side of a square whose perimeter is 25 units?

I have 6.25 units.
Who has the perimeter of a regular pentagon whose sides measure 3.2 units?

I have 16 units.
Who has the length of one side of an isosceles triangle with a perimeter of 20 units. The other two sides measure 8 units each?

I have 4 units.
Who has the perimeter of a parallelogram whose sides measure 3.8 and 9.6 units?

I have 26.8 units.
Who has the width of a rectangle with a perimeter of 30.2 units and a length of 9.5 units?

I have 5.6 units.
Who has the perimeter of a regular decagon whose sides measure 2.5 units?

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I have 25 units.
Who has the perimeter of a quadrilateral whose sides measure 1.2, 3, 5.4 and 1.25 units?

I have 10.85 units.
Who has the length of a side of a square with a perimeter of 125 units?

I have 31.25 units.
Who has the length of a side of a regular pentagon with a perimeter of 35.5 units?

I have 7.1 units.
Who has the perimeter of a rectangle with a length of 2.9 units and a width of 5.8 units?

I have 17.4 units.
Who has the length of a side of a regular octagon with a perimeter of 98 units?

I have 12.25 units.
Who has the perimeter of a quadrilateral whose sides measure 2.3, 1.8, 5.7, and 3.4 units?

I have 13.2 units.
Who has the perimeter of a regular hexagon whose sides measure 4.8 units?

I have 28.8 units.
Who has the length of a rectangle with a perimeter of 8.3 units and a width of 1.7 units?

I have 2.45 units.
Who has the perimeter of a regular pentagon whose sides measure 3.7 units?

I have 18.5 units.
Who has the side of a regular decagon with a perimeter of 98.42 units?

I have 9.842 units.
Who has the perimeter of a equilateral triangle whose sides measure 5.3 units?

I have 15.9 units.
Who has the length of a side of a regular hexagon with a perimeter of 39.6 units?

I have 6.6 units.
Who has the perimeter of a rectangle with a length of 8.4 units and a width of 4.2 units?

I have 25.2 units.
Who has the length of the third side of an isosceles triangle with a perimeter of 34 if the two other sides measure 12.4 units each?

I have 9.2 units.
Who has the perimeter of a quadrilateral whose sides measure 3.6, 5.8, 6.5 and 4.8 units?

I have 20.7 units.
Who has the perimeter of a rhombus whose sides measure 7.25 units?

I have 29 units.
Who has the perimeter of a rectangle with a length of 5.8 units and a width of 4.7 units?

I have 21 units.
Who has the length of a side of a regular pentagon whose perimeter is 19.5 units?

I have 3.9 units.
Who has the perimeter of a scalene triangle whose sides measure 12.2, 14.6 and 7.2 units?

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I have 7.1 units

Who has the perimeter of a rectangle with a length of 2.9 units and a width of 5.8 units?

I have 2.45 units.

Who has the perimeter of a regular pentagon whose sides measure 3.7 units?

I have 17.4 units.

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Who has the perimeter of a regular hexagon whose sides measure 4.8 units?

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I have 26.8 units.

Who has the width of a rectangle with a perimeter of 30.2 units and a length of 9.5 units?

I have 30 units.

Who has the perimeter of a scalene triangle whose sides measure 1.5 units, 2 units and 2.5 units?

I have 5.6 units.

Who has the perimeter of a regular decagon whose sides measure 2.5 units?

I have 6 units.

Who has the length of a side of a square whose perimeter is 25 units?

I have 25 units.

Who has the perimeter of a quadrilateral whose sides measure 1.2 units, 3 units, 5.4 units and 1.25 units?

I have 6.25 units.

Who has the perimeter of a regular pentagon whose sides measure 3.2 units?

I have 10.85 units.

Who has the length of a side of a square with a perimeter of 125 units?

I have 16 units.

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Who has the perimeter of a rectangle with a width of 2.8 units and a length of 4.9 units?

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Who has the perimeter of a regular octagon whose sides measure 2.25 units?

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Who has the perimeter of an isosceles triangle, two of whose sides measure 7.65 units, and whose third side measures 1.7 units?

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Who has the perimeter of a regular hexagon whose sides measure 3.8 units?

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Who has the perimeter of a rectangle with a width of 5 units and a length of twice the width?

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I have 25.2 units.

Who has the length of the third side of an isosceles triangle with a perimeter of 34 if the other 2 sides measure 12.4 units each?

I have 3.9 units.

Who has the perimeter of a scalene triangle whose sides measure 12.2 units, 14.6 units and 7.2 units?

I have 9.2 units

Who has the perimeter of a quadrilateral whose sides measure 3.6 units, 5.8 units, 6.5 units, and 4.8 units?

I have 20.7 units.

Who has the perimeter of a rhombus whose sides measure 7.25 units?

I have 29 units.

Who has the perimeter of a rectangle with a length of 5.8 units and a width of 4.7 units?

I have 21 units.

Who has the length of a side of a regular pentagon whose perimeter is 19.5 units?

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WHAT'S YOUR ANGLE?

GRADE LEVEL: 6

STRAND: Geometry

SKILL: Measure angles

MANAGEMENT

CLASS ORGANIZATION: Whole class, small groups

TIME FRAME: Two math periods

MATERIALS: Calculator, ruler, protractor, blank paper, overhead projector, overhead protractor (optional)

VOCABULARY: Polygon, triangle, rectangle, rhombus, trapezoid, pentagon, hexagon, octagon, diagonal, angle, vertex, degree, interior angle of a polygon, diagonal

PREREQUISITE SKILLS: Use of a protractor, identification of polygons, find averages

LESSON

- **DIRECTED INSTRUCTION:**

NOTE TO TEACHER: The intent of this lesson is for students to "discover" a pattern for the sums of the angles of polygons. It is imperative that each student measure each angle and record her/his measurements. When the students find the average of their measurements they will discover that their sums are close to the multiples of 180°: 180°, 360°, 540°, 720°, 900°, etc.

1. Review the definitions of both regular (all sides equal, all angles equal) and nonregular polygons. The shapes we will be using are: triangles, quadrilaterals, pentagons, hexagons, and octagons. Ask each student to use a ruler to carefully draw at least three of each of the five polygons (triangle, quadrilateral, pentagon, hexagon, and octagon) large enough so that the student can measure each angle of the polygons.

2. Review the use of the protractor to measure angles. Explain that the sides of a polygon may need to be extended in order to help to measure the angles. See figure below.

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- **GUIDED PRACTICE:**

  Students individually measure each of the interior angles in the 3 triangles they drew and find the sum of the angle measurements for each triangle. They record the results on Activity Sheet 1. Assist any student having difficulty.

- **INDEPENDENT PRACTICE:**

  1. Students individually measure all of the interior angles in their remaining polygons and record the results on Student Activity Sheet 1. They also record the sum of the angle measures.

  2. In cooperative groups of four, students record their individual sums onto Student Activity Sheet 2, parts 1 and 2.

  3. Each group calculates and records the average sum of the angle measures of a triangle, quadrilateral, pentagon, hexagon and octagon, respectively.

  4. The averages determined by each group are shared with all other groups. Record on Student Activity Sheet 3, part 1 and 2. This may be done by each group or as a class activity using Student Activity Sheet 3 as an overhead transparency.

  5. Each group writes its conclusion about the sum of the measures of the angles of a polygon from each classification and about the value of using a large sample of data to reach their conclusions.

- **EVALUATION:**

  Each group should discover that the sum of the angles are as follows.

POLYGON	NO. OF SIDES	SUM OF INTERIOR ANGLES
Triangle	3	180°
Quadrilateral	4	360°
Pentagon	5	540°
Hexagon	6	720°
Octagon	8	1080°
n-gon	n	(n-2)180°

If a seven sided polygon was used the sum of the interior angles would be 900°.

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Name _____

WHAT'S YOUR ANGLE?
Student Activity Sheet 1

	Number of Degrees in Angle								Sum of the angle measures
	1	2	3	4	5	6	7	8	
Triangle 1									
Triangle 2									
Triangle 3									
Quadrilateral 1									
Quadrilateral 2									
Quadrilateral 3									
Pentagon 1									
Pentagon 2									
Pentagon 3									
Hexagon 1									
Hexagon 2									
Hexagon 3									
Octagon 1									
Octagon 2									
Octagon 3									

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Names _____ _____ _____ _____

WHAT'S YOUR ANGLE?
COOPERATIVE GROUP DATA SHEET
Student Activity Sheet 2, part 1

	Sum of the Angle Measures in:		
Student 1	Triangle 1: _____ Triangle 2: _____ Triangle 3: _____	Quadrilateral 1: _____ Quadrilateral 2: _____ Quadrilateral 3: _____	Pentagon 1: _____ Pentagon 2: _____ Pentagon 3: _____
Student 2	Triangle 1: _____ Triangle 2: _____ Triangle 3: _____	Quadrilateral 1: _____ Quadrilateral 2: _____ Quadrilateral 3: _____	Pentagon 1: _____ Pentagon 2: _____ Pentagon 3: _____
Student 3	Triangle 1: _____ Triangle 2: _____ Triangle 3: _____	Quadrilateral 1: _____ Quadrilateral 2: _____ Quadrilateral 3: _____	Pentagon 1: _____ Pentagon 2: _____ Pentagon 3: _____
Student 4	Triangle 1: _____ Triangle 2: _____ Triangle 3: _____	Quadrilateral 1: _____ Quadrilateral 2: _____ Quadrilateral 3: _____	Pentagon 1: _____ Pentagon 2: _____ Pentagon 3: _____
	Sum of all the angle measures in the triangles _____ Group Average _____	Sum of all the angle measures in the quadrilaterals _____ Group Average _____	Sum of all the angle measures in the pentagons _____ Group Average _____

Conclusions _____

_____

_____

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Names_____ _____ _____ _____

WHAT'S YOUR ANGLE?
COOPERATIVE GROUP DATA SHEET
Student Activity Sheet 2, part 2

	Sum of the angle measures in:	
Student 1	Hexagon 1: _____ Hexagon 2: _____ Hexagon 3: _____	Octagon 1: _____ Octagon 2: _____ Octagon 3: _____
Student 2	Hexagon 1: _____ Hexagon 2: _____ Hexagon 3: _____	Octagon 1: _____ Octagon 2: _____ Octagon 3: _____
Student 3	Hexagon 1: _____ Hexagon 2: _____ Hexagon 3: _____	Octagon 1: _____ Octagon 2: _____ Octagon 3: _____
Student 4	Hexagon 1: _____ Hexagon 2: _____ Hexagon 3: _____	Octagon 1: _____ Octagon 2: _____ Octagon 3: _____
	Sum of the angles measures in the Hexagons _____ Group Average _____	Sum of the angles measures in the Octagons _____ Group Average _____

Conclusions _____

_____

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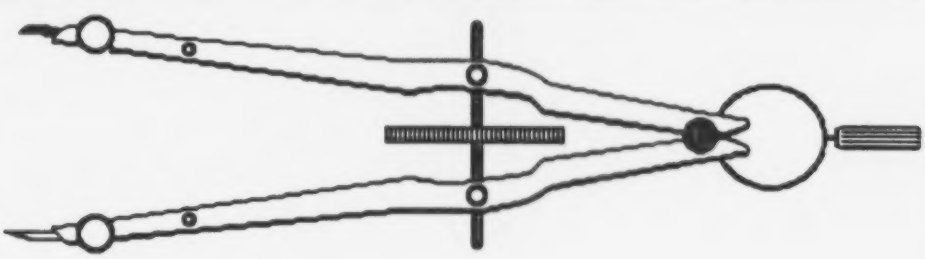
Name _____

WHAT'S YOUR ANGLE?
CLASS DATA SHEET
Student Activity Sheet 3, part 1

RECORD EACH GROUP'S AVERAGE FOR EACH OF THE CATEGORIES IDENTIFIED. THEN FIND THE CLASS GROUP AVERAGE ROUNDED TO THE NEAREST WHOLE NUMBER.

GROUP'S AVERAGES FOR THE SUM OF THE ANGLE MEASURES IN:		
TRIANGLE	**QUADRILATERAL**	**PENTAGON**
Group 1: _____	Group 1: _____	Group 1: _____
Group 2: _____	Group 2: _____	Group 2: _____
Group 3: _____	Group 3: _____	Group 3: _____
Group 4: _____	Group 4: _____	Group 4: _____
Group 5: _____	Group 5: _____	Group 5: _____
Group 6: _____	Group 6: _____	Group 6: _____
Group 7: _____	Group 7: _____	Group 7: _____
Group 8: _____	Group 8: _____	Group 8: _____
Group 9: _____	Group 9: _____	Group 9: _____
Sum of all the angle measures in the triangles	Sum of all the angle measures in the quadrilaterals	Sum of all the angle measures in the pentagons
GROUP AVERAGE: _____	GROUP AVERAGE: _____	GROUP AVERAGE: _____



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Name_____

WHAT'S YOUR ANGLE?
CLASS DATA SHEET
Student Activity Sheet 3, part 2

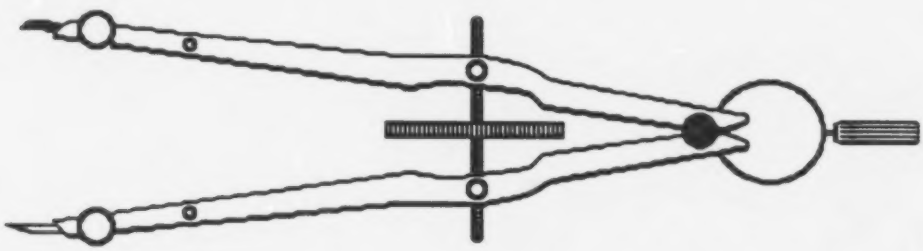
GROUP'S AVERAGES FOR THE SUM OF THE ANGLE MEASURES IN:	
HEXAGON	**OCTAGON**
Group 1: _____	Group 1: _____
Group 2: _____	Group 2: _____
Group 3: _____	Group 3: _____
Group 4: _____	Group 4: _____
Group 5: _____	Group 5: _____
Group 6: _____	Group 6: _____
Group 7: _____	Group 7: _____
Group 8: _____	Group 8: _____
Group 9: _____	Group 9: _____
Sum of all the angle measures in the Hexagons_____	Sum of all the angle measures in the Octagons_____
GROUP AVERAGE: _____	GROUP AVERAGE: _____

CONCLUSION:_____

_____

_____

_____



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IT'S ALL IN HOW YOU LOOK AT IT

GRADE: 5 - 6

STRAND: Measurement/Geometry

SKILL: Find areas of triangles

MANAGEMENT

CLASS ORGANIZATION: Whole class, pairs

TIME FRAME: Two math periods

MATERIALS: Calculator, Transparency of Student Activity Sheet 1, metric rulers

VOCABULARY: Height, base, vertex, perpendicular, line segment

PREREQUISITE SKILL: Measurement skills

LESSON

This lesson shows that any of the 3 sides of a triangle can be thought of as the base when using the formula "A = .5 x base x height" to find the area of a triangle.

Note: .5 is used instead of $\frac{1}{2}$ because it is easier to use with the calculator.

Throughout this lesson the word **height** will refer to both a triangle's altitude and the measure of the altitude.

- **DIRECTED INSTRUCTION:**
  - Hand out Student Activity Sheet 1.
  - Review listed vocabulary.
  - Tell the class:
    - Solid lines form the triangle ABC,
    - Dashed lines are either extensions of sides or heights of the triangle.
  - Students turn their paper so that $\overline{AC}$ is parallel to the edge of their desks. For now, $\overline{AC}$ is the base.
  - Tell the class:
    - The height is drawn from the vertex opposite a base to the line containing the base, so that it is perpendicular to the base.
    - In some cases, the height will touch the base, and in other instances, it touches an extension of the base.
  - Students answer question 1.
  - Discuss why $\overline{BD}$ is the height.
  - Students follow a similar process for $\overline{AB}$ and $\overline{BC}$ to answer question 2 and 3.
  - Discuss results. Do the first line of the chart with the class, then students complete the chart on the bottom of their Student Activity Sheet.
  - Ask students if their three answers for the area of the triangle ABC are exactly the same.
  - Discuss that all measurements involve approximations, so that the three area measurements should be close to each other but will not necessarily come out exactly the same.

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- **GUIDED PRACTICE:**
  Hand out Student Activity Sheet 2. Students complete the chart for triangle ACE. Discuss student results.

- **INDEPENDENT PRACTICE:**
  Students complete the chart for triangles HKG and NPM. Discuss the fact that the height may be the same as a side of the triangle. Hand out Student Activity Sheet 3 parts 1 and 2. Students complete the Activity Sheet, then discuss results.

- **EVALUATION:**
  Observe responses on Student Activity Sheets.

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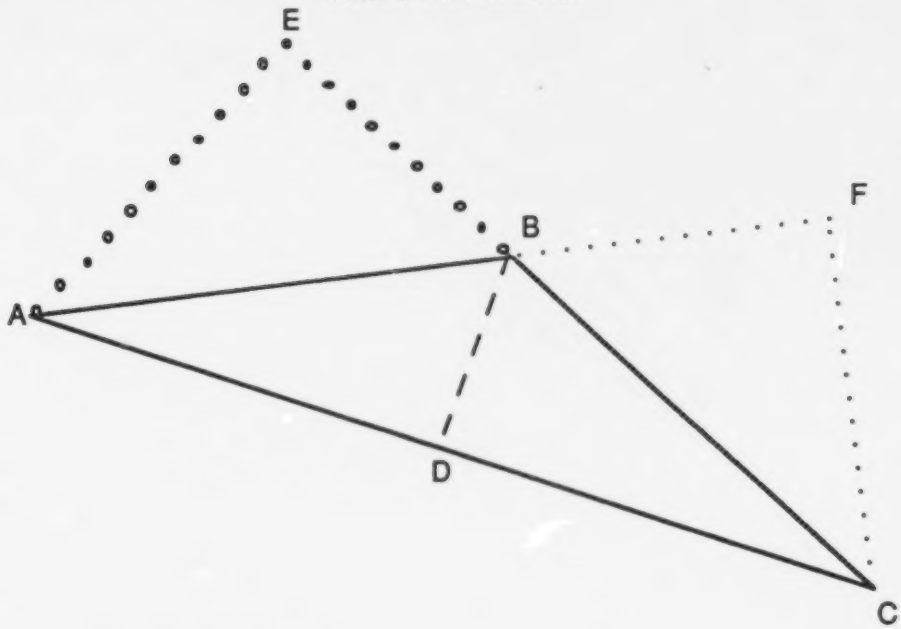
IT'S ALL IN HOW YOU LOOK AT IT

Student Activity Sheet 1
Teacher Answer Sheet



- The height is drawn from the vertex opposite a base to the line containing the base, and perpendicular to the base.
- In some cases, the height will touch the base and in other instances, it touches an extension of the base.

Look at ΔABC

1. If you use $\overline{AC}$ as the base, the height would be line segment $\overline{DB}$

2. If you use $\overline{AB}$ as the base, the height would be line segment $\overline{CF}$

3. If you use $\overline{BC}$ as the base, the height would be line segment $\overline{AE}$

4. **Area of triangle = .5 x base x height**

Base	Vertex opposite the base	Height	Measure of Base round to the nearest tenth of a cm	Measure of Height round to the nearest tenth of a cm	.5 x B x H	≈ Area round to the nearest tenth of a cm^2
$\overline{AC}$	B	$\overline{BD}$	13.7	3.2	21.39	21.9
$\overline{BC}$	A	$\overline{AE}$	7.7	5.7	21.945	21.9
$\overline{AB}$	C	$\overline{CF}$	7.5	5.8	21.75	21.8

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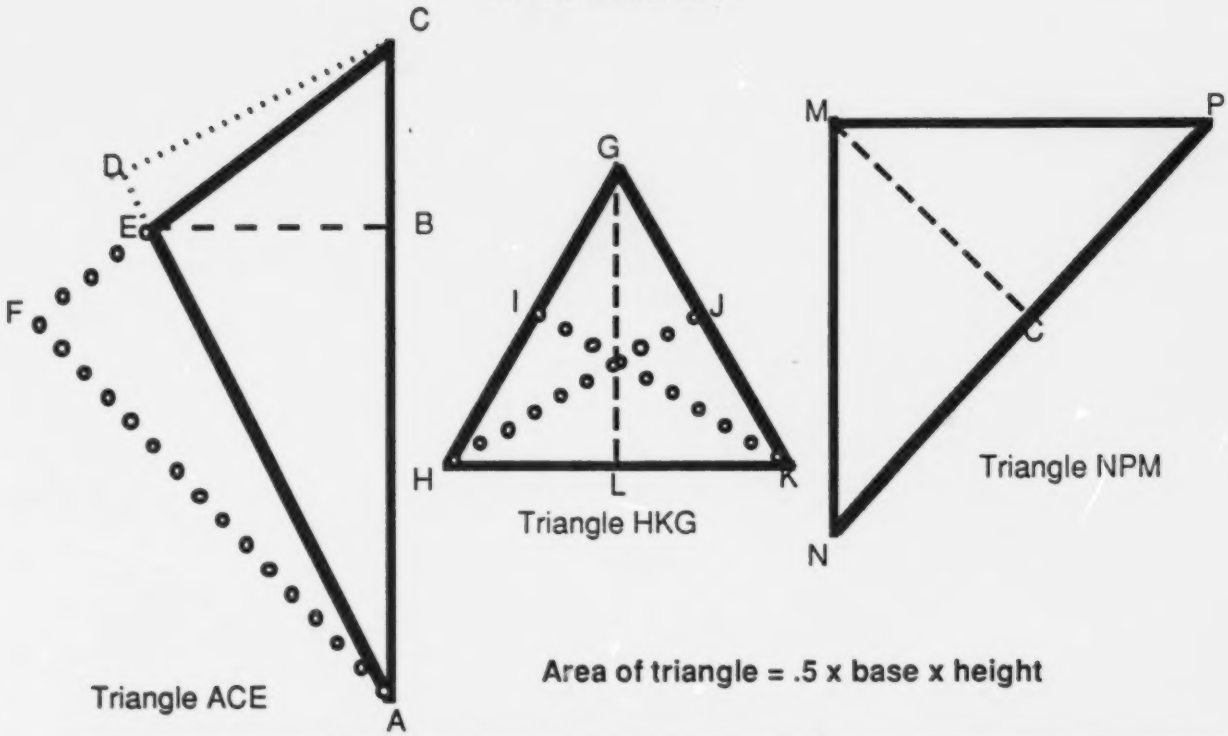
IT'S ALL IN HOW YOU LOOK AT IT
Student Activity Sheet 2
Teacher Answer Sheet



Area of triangle = .5 x base x height

Triangle	Base	Height	Measure of Base round to the nearest tenth of a cm	Measure of Height round to the nearest tenth of a cm	.5 x B x H	= Area round to the nearest tenth of a cm^2
ACE	$\overline{AC}$	$\overline{BE}$	9.7	3.5	16.975	17.0
ACE	$\overline{BC}$	$\overline{AF}$	4.5	7.8	17.55	17.6
ACE	$\overline{AE}$	$\overline{DC}$	7.8	4.5	17.55	17.6
HKG	$\overline{HK}$	$\overline{GL}$	5.0	4.4	11	11.0
HKG	$\overline{GK}$	$\overline{HJ}$	5.0	4.4	11	11.0
HKG	$\overline{GH}$	$\overline{KI}$	5.0	4.4	11	11.0
NPM	$\overline{PM}$	$\overline{MN}$	5.5	6.0	16.5	16.5
NPM	$\overline{MN}$	$\overline{MP}$	6.0	5.5	16.5	16.5
NPM	$\overline{PN}$	$\overline{MC}$	8.2	4.0	16.4	16.4

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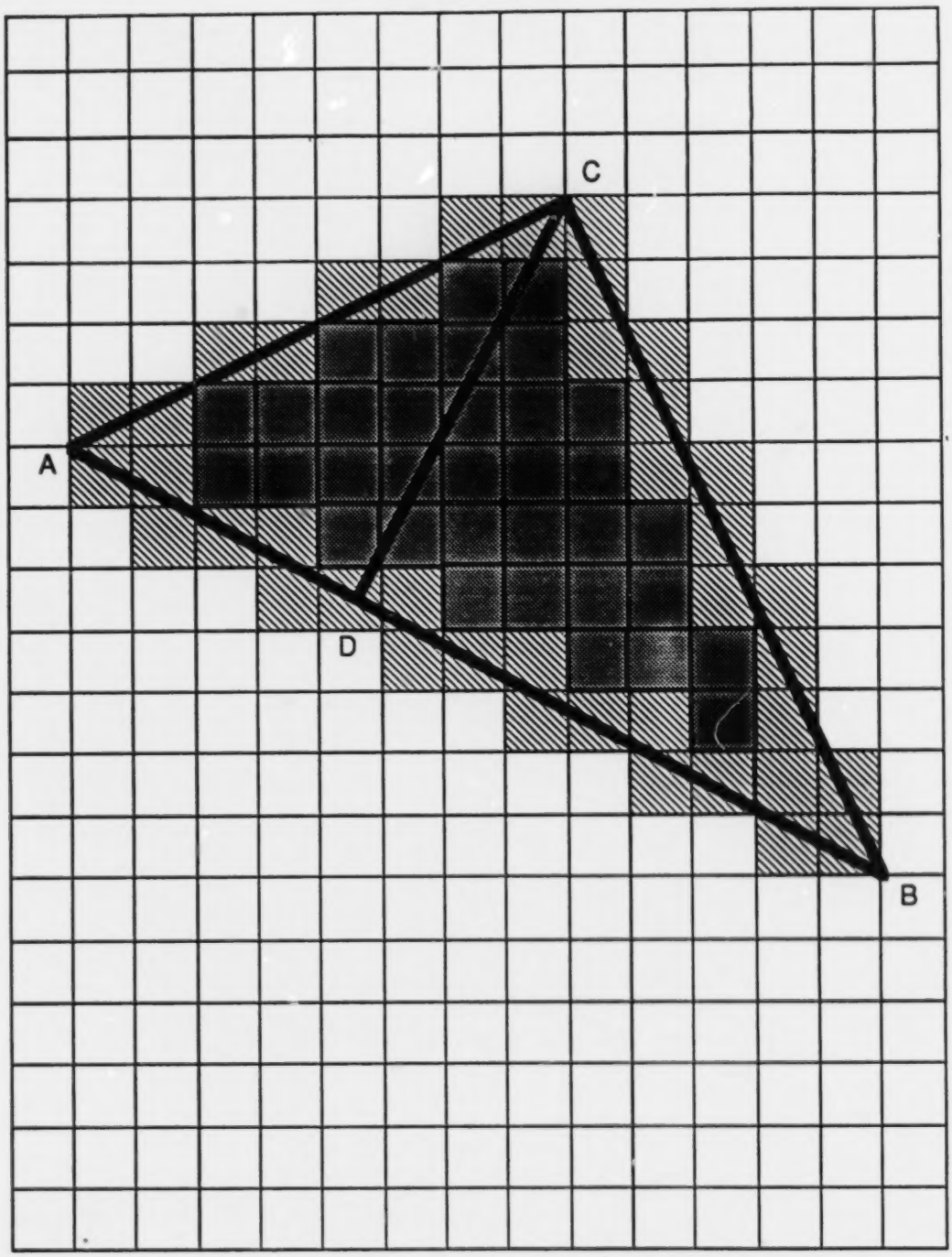
IT'S ALL IN HOW YOU LOOK AT IT
Teacher Answer Sheet 3



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IT'S ALL IN HOW YOU LOOK AT IT
Student Activity Sheet 4
Teacher Answer Sheet

1. Estimate the area of triangle ΔABC. ___answer will vary___ sq. cm

2. Lightly shade in and then count the number of squares which are completely inside of ΔABC. There are ___34___ squares. Is this greater than or smaller than the area of the triangle? ___smaller___

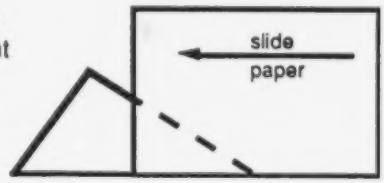
3. If the result from question 2 changes your estimate for the area of ΔABC, write your new estimate. ___answer will vary___ sq. cm

4. Lightly shade in all squares that have any part of them inside ΔABC. Count the total number of squares you have shaded so far in this lesson (All squares totally or partly in the triangle). There are ___74___ squares. Is this greater than or smaller than the area of the triangle? ___greater___

5. If the result from question 4 changes your estimate for the area of ΔABC, write your new estimate. ___answer will vary___ sq. cm

6. Look at triangle ΔABC. Choose one side to be a base. Use a dash line for the height. (Hint: slide a piece of paper along the base you have chosen until it lines up with the opposite vertex. Use the edge of the paper as a guide for dashing in the height.)

Measure of Base	Measure of Height	Area of Triangle ABC
Possible answer:		.5 x base x height
$\overline{AB}$ 15 cm	$\overline{CD}$ 7.2 cm	54 cm^2
$\overline{AC}$ 9 cm	$\overline{BC}$ 12 cm	54 cm^2
$\overline{BC}$ 12 cm	$\overline{AC}$ 9 cm	54 cm^2



7. Which was closer to the area of ΔABC, your answer to question 1, 3, or 5? ___

Why? _____

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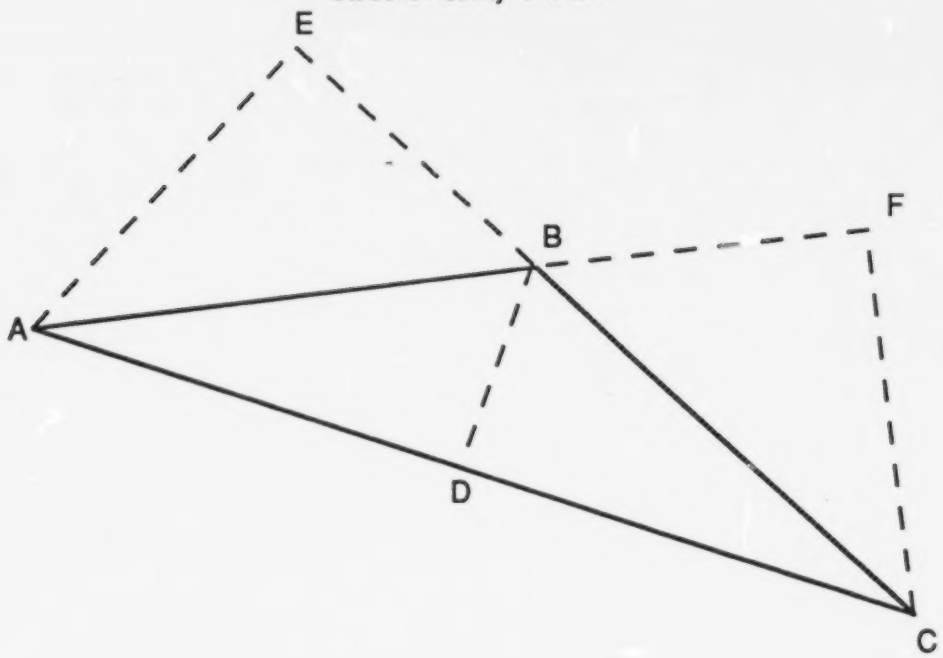
Name _____

IT'S ALL IN HOW YOU LOOK AT IT

Student Activity Sheet 1



- The height is drawn from the vertex opposite a base to the line containing the base, and perpendicular to the base.
- In some cases, the height will touch the base and in other instances, it touches an extension of the base.

Look at ΔABC

1. If you use $\overline{AC}$ as the base, the height would be line segment _____
2. If you use $\overline{AB}$ as the base, the height would be line segment _____
3. If you use $\overline{BC}$ as the base, the height would be line segment _____
4. **Area of triangle = .5 x base x height**

Base	Vertex opposite the base	Height	Measure of Base round to the nearest tenth of a cm	Measure of Height round to the nearest tenth of a cm	.5 x B x H	= Area round to the nearest tenth of a cm^2
$\overline{AC}$						
$\overline{BC}$						
$\overline{AB}$						

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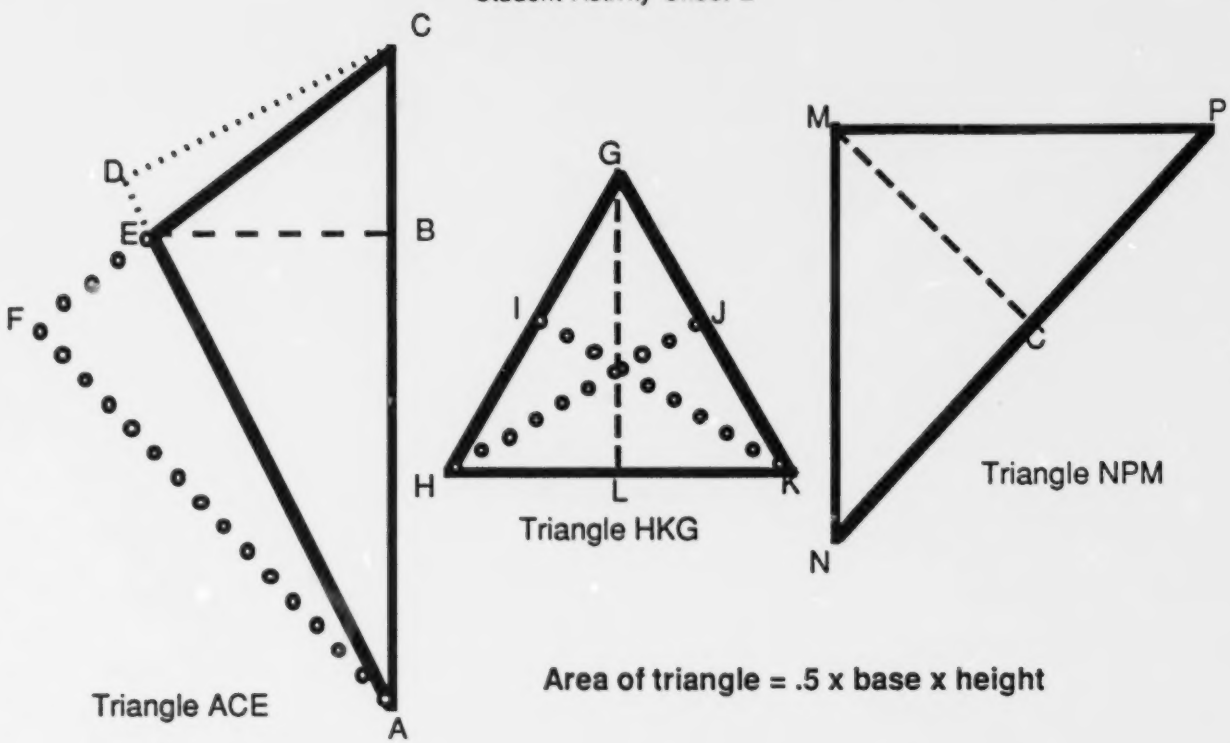
Name _____

IT'S ALL IN HOW YOU LOOK AT IT

Student Activity Sheet 2



Area of triangle = .5 x base x height

Triangle	Base	Height	Measure of Base round to the nearest tenth of a cm	Measure of Height round to the nearest tenth of a cm	.5 x B x H	≈ Area round to the nearest tenth of a cm^2
ACE	$\overline{AC}$					
ACE	$\overline{EC}$					
ACE	$\overline{AE}$					
HKG	$\overline{HK}$					
HKG	$\overline{GK}$					
HKG	$\overline{GH}$					
NPM	$\overline{PM}$					
NPM	$\overline{MN}$					
NPM	$\overline{PN}$					

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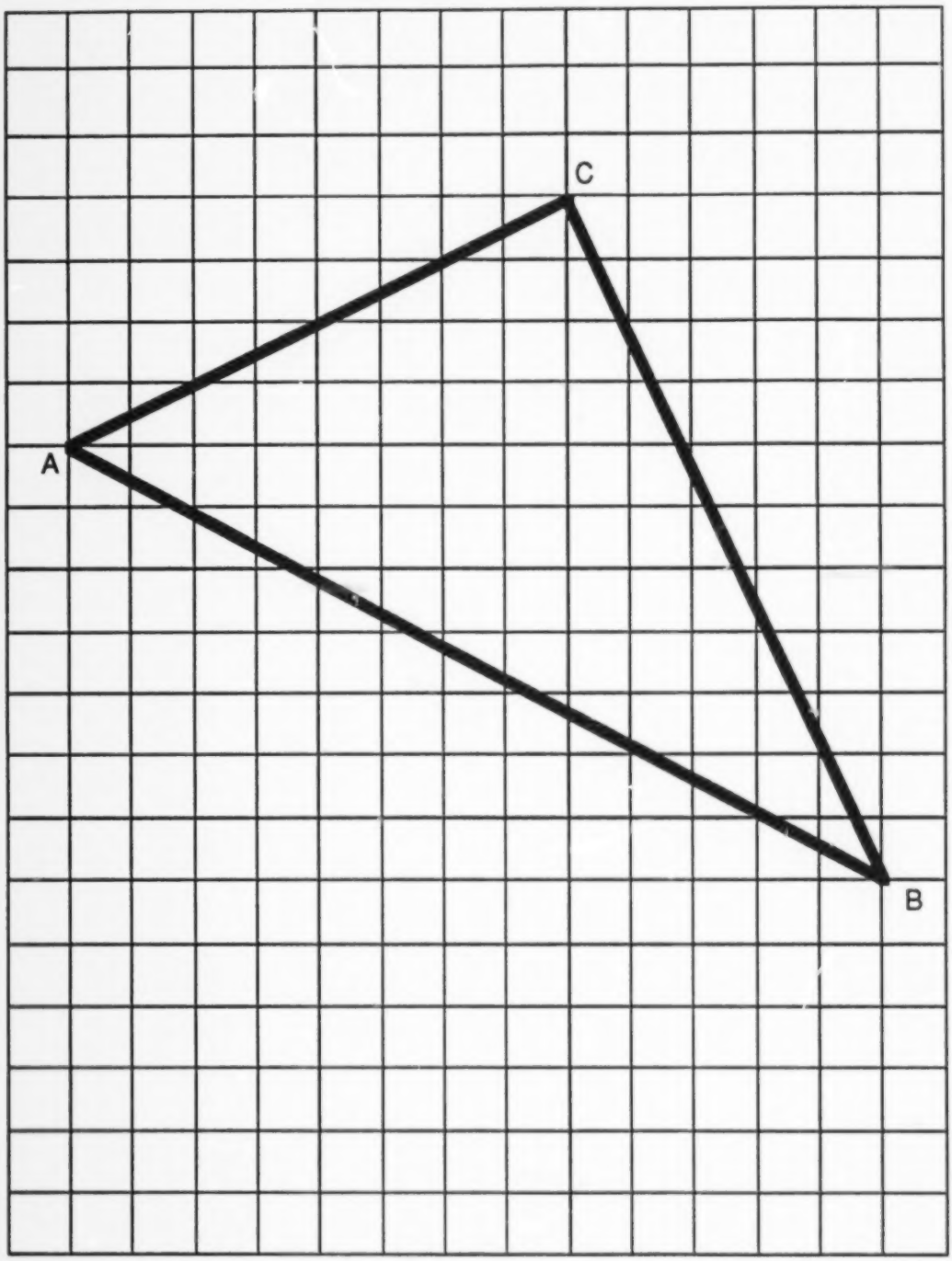
IT'S ALL IN HOW YOU LOOK AT IT
Student Activity Sheet 3, part 1



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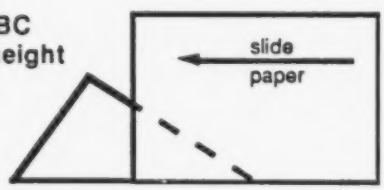
Name _____

IT'S ALL IN HOW YOU LOOK AT IT
Student Activity Sheet 3, part 2

1. Estimate the area of triangle ΔABC. _____ sq. cm
2. Lightly shade in and then count the number of squares which are completely inside of ΔABC. There are _____ squares. Is this greater than or smaller than the area of the triangle? _____
3. If the result from question 2 changes your estimate for the area of ΔABC, write your new estimate. _____ sq. cm
4. Lightly shade in all squares that have any part of them inside ΔABC. Count the total number of squares you have shaded so far in this lesson (All squares totally or partly in the triangle). There are _____ squares. Is this greater than or smaller than the area of the triangle? _____
5. If the result from question 4 changes your estimate for the area of ΔABC, write your new estimate. _____ sq. cm
6. Look at triangle ΔABC. Choose one side to be a base. Use a dash line for the height. (Hint: slide a piece of paper along the base you have chosen until it lines up with the opposite vertex. Use the edge of the paper as a guide for dashing in the height.)

Measure of Base	**Measure of Height**	**Area of Triangle ABC .5 x base x height**
_____	_____	_____



7. Which was closer to the area of ΔABC, your answer to question 1, 3, or 5? ___

   _____

   Why? _____

   _____

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CIRCLE TO THE RIGHT

GRADE: 5 - 6

STRAND: Geometry/Measurement

SKILL: Explore triangles inscribed in a circle.
Discover the relationship between the sides of a right triangle (Pythagorean Theorem).

MANAGEMENT

CLASS ORGANIZATION: Whole class, pairs

TIME FRAME: Two math periods

MATERIALS: Calculators, metric ruler, protractor, colored pencils (optional), overhead transparency

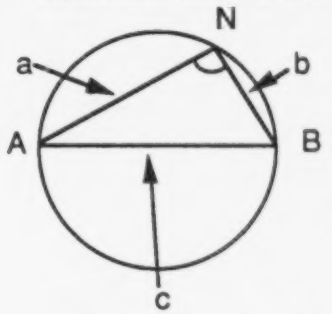
VOCABULARY: Line segment, chord, vertex

PREREQUISITE SKILL: Measure to the nearest tenth of a cm, measure angles using protractors

LESSON

This lesson will give students practice in measurement and lead to geometric discoveries.

- **DIRECTED AND GUIDED INSTRUCTION:**



Use the transparency or draw a circle on the board and construct diameter, $\overline{AB}$. Select a point on the circle and connect it to points A and B to form an angle and to complete a triangle. Use your diagram to point out what angle and sides to measure. The point they draw on the circle becomes the vertex of the angle to be measured.

Point out that "a" represents the measure of $\overline{AN}$,
"b" represents the measure of $\overline{BN}$ and
"c" represents the measure of diameter $\overline{AB}$.

- Note, we use "diameter" to mean the line segment AB and the measure of $\overline{AB}$. The context makes it clear to which we are referring.

- **INDEPENDENT PRACTICE:**

Hand out Student Activity Sheets 1 and 2. Explain the 9 columns on Student Activity Sheet 2. Students complete the activity sheets. Students may use colored pencils to help keep track of the triangles they are drawing.

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Afterwards the class discusses their observations. Be sure that the following items are discussed:

1. The angle formed by connecting points A and B to the vertex point chosen on the circle is always a right angle. They need to know that their measures may not have been exactly 90° each time due to the approximation inherent in drawing lines and in measurement.

2. All the triangles drawn are right triangles. In triangles that contain a 90° angle it's always true that $a^2 + b^2 = c^2$. This is called the Pythagorean Theorem. Again, they will probably not have exactly the same answer for $a^2 + b^2$ and for c^2 because of the approximations involved in measurement.

- **EVALUATION:**
  Observation of responses on the Student Activity Sheets.

- **HOME ACTIVITY or EXTENSION PROBLEMS:**
  Use circles with various sized diameters. To minimize measurement error, suggest they use circles of diameter 6 inches or larger.

1. Will the angle formed by connecting the endpoints of a diameter to the point chosen on the circle still be a right angle? _____yes_____

2. Will $a^2 + b^2$ still equal c^2 in the triangles formed? _____yes_____

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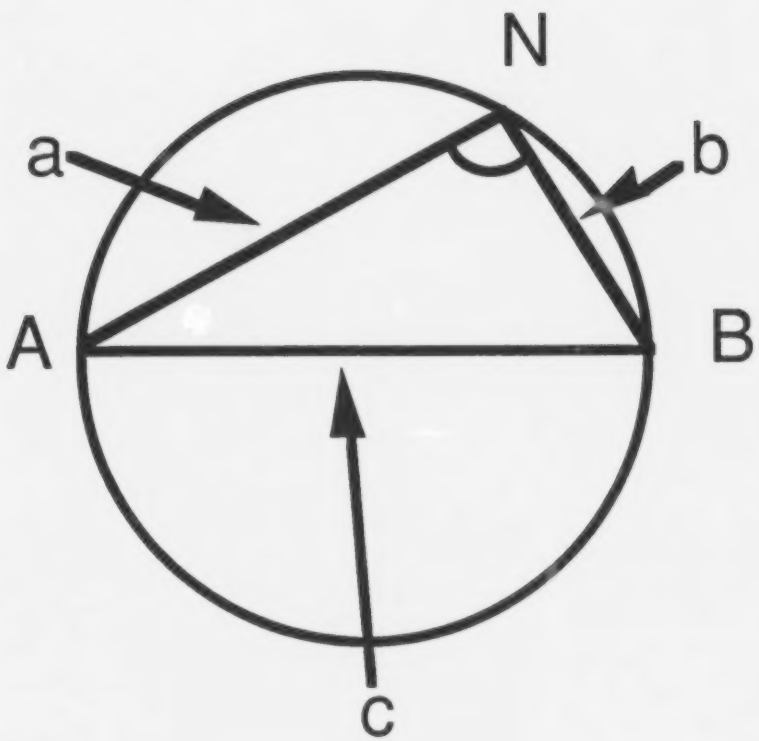
CIRCLE TO THE RIGHT
(OH)



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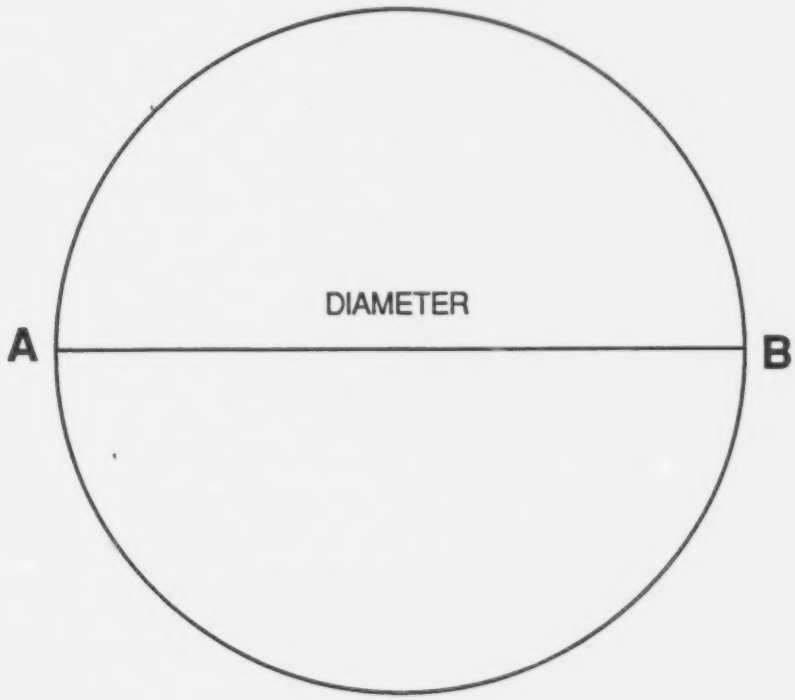
NAME _____

CIRCLE TO THE RIGHT
Student Activity Sheet 1



1. Choose and label a point (vertex) on the circle different from A or B. Draw line segments connecting the point you chose with endpoints A and B (of diameter $\overline{AB}$) to form an angle. The point you draw becomes the vertex of an angle. Enter the name of this angle in column #1 of the chart on the next page.

   The two line segments you draw from your point will also complete a triangle. The measures of those two line segments will be referred to as "a" and "b". The measure of the diameter, $\overline{AB}$, will be referred to as "c".

2. Use a protractor to measure the new angle formed and record in column 2.

3. Measure (to the nearest tenth of a centimeter) the line segment connecting point A with your new point and record in column 3.

4. Measure (to the nearest tenth of a centimeter) the line segment connecting point B with your point and record in column 4.

5. Measure (to the nearest tenth of a centimeter) the diameter $\overline{AB}$ and record in column 5.

6. Compute columns 6, 7, 8, and 9. Use your calculator. Repeat this entire process for at least 4 different points that you will draw on the circle. Use the chart to examine all your measurements and findings before answering the questions at the bottom of the page.

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CIRCLE TO THE RIGHT
Student Activity Sheet 2

Use directions from Student Activity Sheet 1

1	2	3	4	5	6	7	8	9
Name of angle	Measure of angle	a	b	c	a^2 round to the nearest tenth of a cm^2	b^2 round to the nearest tenth of a cm^2	c^2 round to the nearest tenth of a cm^2	$a^2 + b^2$ round to the nearest tenth of a cm^2

1. What do you observe about the measure of angles recorded in column 2? _____

_____

_____

_____

2. What do you observe about the relationship between $a^2 + b^2$, and c^2? _____

_____

_____

_____

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I SEARCH, YOU SEARCH, WE ALL SEARCH FOR AREAS

GRADE: 5 - 6

STRAND: Measurement/Geometry

SKILL: Compute area of triangles.

MANAGEMENT

CLASS ORGANIZATION: Whole class, pairs

TIME FRAME: Two math periods

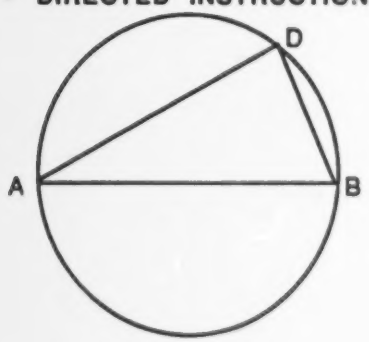
MATERIALS: Calculator, metric ruler

VOCABULARY: Right triangle, point, diameter, angle, perpendicular

PREREQUISITE SKILL: Compute area of triangles, round decimals
Optional: If possible do the lessons 19 and 20 first to gain a greater understanding of the geometry involved.

LESSON

- **DIRECTED INSTRUCTION:**



- Draw a circle on the board or on an overhead transparency; draw any diameter and label it $\overline{AB}$.
- Place a point on the circle at a different location from points A and B and label it D.
- Connect this new point D to form ΔADB.
- Mention that no matter where on the circle you put point D, $\angle ADB$ will be a 90° angle. (This concept was explored in Lesson 20.)
- Explain that since you have a right triangle, you can use $\overline{DB}$ and $\overline{AD}$ as the base and height of the triangle. It doesn't matter which one we call the base, the other segment will be the height.
- Students may rotate their paper so that $\overline{AD}$ or $\overline{DB}$ is in a line parallel to the edge of their desks in order to clearly identify the right triangle. Students may slide a corner of a piece of paper onto angle D to prove that it is a right angle.
- Review the formula for finding the area of a triangle (Area = .5 x base x height).

- **GUIDED PRACTICE:**

Hand out the Student Activity Sheet. Students choose and label a point on their circle. They follow directions in order to create a triangle and find its area. Answers will vary.

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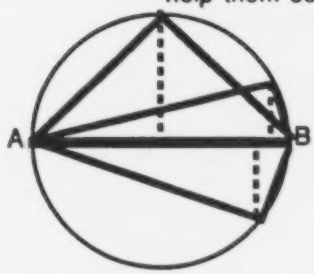
- **INDEPENDENT PRACTICE:**

  Students complete the Student Activity Sheet. Upon completion of the worksheet, discuss the results and observations with the class.

  They may have noticed that the closer the point they chose was to point A or point B, the smaller the area of the triangle. The maximum area occurs when the point chosen is equidistant from points A and B.

  This can be explained geometrically by thinking about the triangle differently than before. Consider $\overline{AB}$ as the base. Notice that the height drawn would get smaller the closer you place the point to A or B. You can help them see the following generalization:



  For triangles having the same base, the greater the height the greater the area.

  Also, demonstrate this property by analyzing the area formula A = .5 x base x height.

- **EVALUATION:**

  Observation of responses on Student Activity Sheet.

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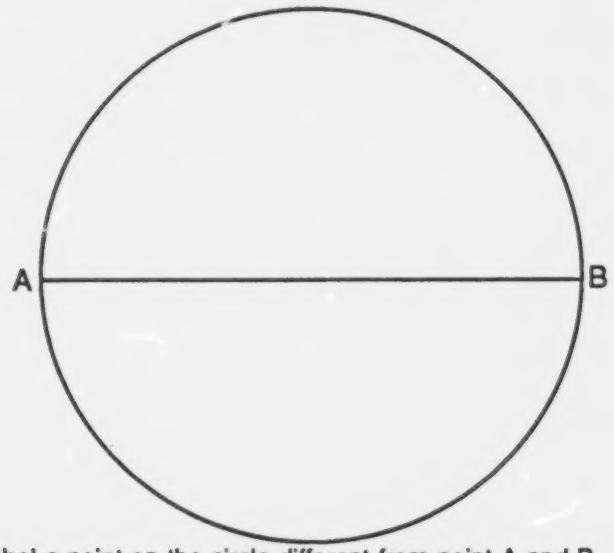
I SEARCH, YOU SEARCH, WE ALL SEARCH FOR AREAS

Student Activity Sheet



- Choose and label a point on the circle different from point A and B.
- Connect this point to points A and B to form a triangle.
  (Note: Use the two line segments you drew as the base and height of a right triangle.)
- Find the area of the triangle you formed and record your results in the chart below.
- Choose at least 3 more points and repeat the process.
- Try to locate the point on the circle which creates the triangle with the largest possible area.

	Name of triangle formed by connecting A and B to the point you chose	Measure of BASE to the nearest tenth of a cm	Measure of HEIGHT to the nearest tenth of a cm	Area of triangle .5 x base x height
1				
2				
3				
4				
5				
6				
7				
8				

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What do you observe about the relationship between the location of the point you pick and the area of the triangle formed? _____

_____

_____

_____

- Return to your original eight triangles.
- This time, for each triangle, compute the area using $\overline{AB}$ as the base (all triangles will have the same base, $\overline{AB}$). You will need to estimate the height by finding the perpendicular distance from the point on the circle to the diameter $\overline{AB}$.

	Name of triangle formed by connecting A and B to the point you chose	Measure of $\overline{AB}$ to the nearest tenth of a cm	Measure of HEIGHT to the nearest tenth of a cm	Area of triangle .5 x base x height
1				
2				
3				
4				
5				
6				
7				
8				

Explain your results. _____

_____

_____

_____

CAMP-LA
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FOLDING PAPER

GRADE: 5 - 6

STRAND: Geometry

SKILL: Find perimeter of rectangles, and area of rectangular regions. Identify, extend, and create number patterns.

MANAGEMENT

CLASS ORGANIZATION: Whole class, small group

TIME FRAME: One math period

MATERIALS: Calculator, 8.5" by 11" paper, rulers

VOCABULARY: Perimeter, area, rectangle, rectangular region

PREREQUISITE SKILL: Perimeter and area of rectangles

LESSON

- **DIRECTED INSTRUCTION and GUIDED PRACTICE:**

1. Give students a piece of paper (8.5 by 11) inches and the Student Record Sheet. Find the perimeter of the rectangle represented by the paper. [P = 39 in.] Find the area of the rectangular region of the paper. [A = 93.5 sq. in.]

2. Fold the piece of paper in half matching the 8.5 inch edges together. This is sometimes called a "hamburger fold" (folding along the width) versus a "hotdog fold" (folding along the length). What are the dimensions of the new rectangle? [8.5 by 5.5] Find the perimeter of the new rectangle. [P = 28 in.] Find the area of the rectangular region. [A= 46.75 sq. in.]

3. Fold the paper in half again, matching the 5.5 inch edges together ("hamburger fold"). Find the:

Length	[5.5 in.]
Width	[4.25 in.]
Perimeter	[P= 19.5 in.]
Area	[A= 23.375 sq. in.]

- **INDEPENDENT PRACTICE:**

1. Repeat the activity by folding the paper in half, always matching the shorter sides. Continue until you complete the chart. Look for patterns.

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EVALUATION:

1. How did the length and width of the rectangle change after you folded the paper? [The width of the new rectangle is .5 (the length of the previous rectangle), and the length of the new rectangle was the width of the previous rectangle.]

2. How did the perimeter of the rectangle change? [The perimeter of the third rectangle was .5 of the perimeter (the first rectangle). The perimeter of the fourth rectangle was .5 (the perimeter of the second rectangle), and so on.]

3. How did the area of the new rectangular region change? [The area of the new rectangular region was .5 (the area of the previous rectangular region).]

HOME ACTIVITY:

Each student measures his or her room to find :

1. The perimeter and area of the floor.

2. The perimeter and area of one wall.

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FOLDING PAPER

Student Record Sheet

Teacher Answer Sheet

	Length Longer side	Width Shorter side	Perimeter	Area (calculator display)
Original paper	11 in.	8.5 in.	39 in.	93.5 sq. in.
First Fold	8.5 in.	5.5 in.	28 in.	46.75 sq. in.
Second Fold	5.5 in.	4.25 in.	19.5 in.	23.375 sq. in.
Third Fold	4.25 in.	2.75 in.	14 in.	11.6875 sq. in.
Fourth Fold	2.75 in.	2.125 in.	9.75 in.	5.84375 sq. in.
Fifth Fold	2.125 in.	1.375 in.	7 in.	2.921875 sq. in.
Sixth Fold	1.375 in.	1.0625 in.	4.875 in.	1.4609375 sq. in.
Seventh Fold	1.0625 in.	0.68755 in.	3.5 in.	0.73046875 sq. in. (0.7304687)
Eighth Fold	0.6875 in.	0.53125 in.	2.4375 in.	0.365234375 sq. in. (0.3652343)
Ninth Fold	0.53125 in.	0.34375 in.	1.75 in.	0.1826171875 sq. in. (0.1826171)
Tenth Fold	0.34375 in.	0.265625 in.	1.21875 in.	0.09130859375 sq. in. (0.0913085)

Write any patterns you found and conclusions you reached from the data above.

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Name _____

FOLDING PAPER
Student Record Sheet

	Length Longer side	Width Shorter side	Perimeter	Area (calculator display)
Original paper	11 in.	8.5 in.	39 in.	93.5 sq. in.
First Fold	8.5 in.	5.5 in.		
Second Fold				
Third Fold				
Fourth Fold				
Fifth Fold				
Sixth Fold				
Seventh Fold				
Eighth Fold				
Ninth Fold				
Tenth Fold				

Write any patterns you found and conclusions you reached from the data above.

_____

_____

_____

_____

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EASY AS PI (π)

GRADE: 5 - 6

STRAND: Geometry/Measurement

SKILL: Measure length to the nearest tenth of a centimeter. Find the circumference of a circle. Round to the nearest hundredth.

MANAGEMENT:

CLASS ORGANIZATION: Whole class, individual

TIME FRAME: One or two math periods

MATERIALS: Calculator, metric measuring tape, cylindrical containers, circular objects

VOCABULARY: Diameter, circumference, pi (π), cylinder, ratio, irrational number, approximation

PREREQUISITE SKILL: Measure length with a tape to the nearest tenth of a cm, rounding decimals

LESSON

- **DIRECTED INSTRUCTION AND GUIDED PRACTICE:**

1. Assign students to bring different cylindrical containers or other circular objects to class.

2. Organize the class into groups of four students. Select ten cylindrical containers for each group.

3. Students measure the diameter and circumference of each circular object and keep a record of the measurements on the Group Activity Sheet. [Measure to the nearest tenth of a centimeter.] Use the Overhead Visual to assist students throughout the development of the activity. Students divide the circumference of each can by its diameter. [Calculate to the nearest hundredth. Each of the calculations should have a ratio of about 3.1.]

4. Use the Group Activity Sheet. Students find the average of the ten calculations. [Add the ten calculations, then divide by ten. The average of each group should have a ratio of over 3.1.]

5. Find the average of the calculations of the group results. [Add the calculations of each of the groups, then divide by the number of groups. The groups' average should have a ratio of about 3.1.]

6. Generalize about the circumference divided by the diameter (C ÷ d) for any circle. Compare the averages for each of the groups [C ÷ d should be approximately 3.14.]

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7. Introduce the term *pi* and the Greek letter π as the ratio between the circumference of a circle and its diameter. Stress the fact that we use π to compute areas and circumferences of circles. Since measurement involves approximation, all numbers we get in this lesson are approximations. Moreover, π is an *irrational number* (not rational). This means it can not be represented exactly as a terminating or repeating decimal or as a fraction.

- **INDEPENDENT PRACTICE:**

1. Use the Student Activity Sheet. Students measure the circumferences and diameters of five cylindrical containers.
2. Record the measurements on the sheet.
3. Find an approximation of π by dividing the circumference of each circle by its diameter.
4. Find the average of the five approximations to π.
5. Compare the average with other students' averages in the class.

- **EVALUATION:**

Observe whether the students understand that the ratio between the circumference of a circle and its diameter is approximately 3.14; that we name the ratio *pi*, and that the symbol for *pi* is π.

- **HOME ACTIVITY:**

Tell students:

1. Find five different cylindrical containers at home.
2. Measure the circumference and diameter of each container.
3. Use the Home Activity Sheet to record your measurements.
4. Find approximations of π.
5. Check to see if your results are approximately equal to 3.14.

- **EXTENSION:**

History of Pi (π).

1. Write $\pi \approx 3.14159263589793238462643...$ on the chalkboard.
2. Note: there are an infinite number of places beyond the decimal point. This number is an approximation of pi (π) as computed by modern computers. Pi (π) is an *irrational* number.

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3. List the following approximation for π on the board and let students compute the number:

   a. Babylonians (2000 B.C.) $\pi = \frac{256}{81} = 3.1604938$

   b. Archimedes (212 B.C.) $\pi = 3\frac{1}{7} = 3.1428571$

   c. Chinese (450 A.D.) $\pi = \frac{355}{113} = 3.1415929$

   d. Hindu (1150 A.D.) $\pi = \frac{3927}{1250} = 3.1416$

   e. Fibonacci (1220 A.D.) $\pi = \frac{864}{274} = 3.1532846$

4. How do these approximations compare to the computer generated value?

5. How do these results compare to your (or the class) approximation for pi(π)?

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EASY AS PI (π)

Transparency

Container	Circumference (nearest tenth)	Diameter (nearest tenth)	C ÷ d	Approximations for π (nearest hundredth)
Coffee cup	26.7	8.5	3.1411764	3.14

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Names _____

_____

_____

_____

EASY AS PI (π)

Group Activity Sheet

Container	Circumference (nearest 10^{th})	Diameter (nearest 10^{th})	C ÷ d	Approximations for π (nearest hundredth)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

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Name_____

EASY AS PI (π)
Student Activity Sheet

1. Select five cylindrical containers or other circular objects.
2. Measure the circumference and diameter of each conatainer.
3. Use the chart to record your measurements.
4. Calculate and find approximations to π by dividing the circumference of each circle by its diameter.
5. Find the average of your five approximations of π.

Container	Circumference (nearest 10^{th})	Diameter (nearest 10^{th})	C ÷ d	Approximations for π (nearest hundredth)
1				
2				
3				
4				
5				

Average of all 5 approximations for pi (π):

$$\frac{\#1 + \#2 + \#3 + \#4 + \#5}{5} = _____$$

Pi (π) is approximately equal to _____

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Name_____

EASY AS PI (π)
Home Activity Sheet

1. Find five different cylindrical containers or other circular objects at home.
2. Measure the circumference and diameter of each container.
3. Use the chart to record your measurements.
4. Calculate to find approximations of π.

Container	Circumference (nearest 10^{th})	Diameter (nearest 10^{th})	C ÷ d	Approximations for π (nearest hundredth)
1				
2				
3				
4				
5				

Average of all 5 approximations for pi (π):

$$\frac{\#1 + \#2 + \#3 + \#4 + \#5}{5} = _____$$

Pi (π) is approximately equal to _____

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THE WHEELS ON THE BIKE GO ROUND AND ROUND

GRADE: 5 - 6

STRAND: Geometry/Measurement

SKILL: Apply circumference formula to real life situations.

MANAGEMENT

CLASS ORGANIZATION: Whole class, pairs

TIME FRAME: One math period

MATERIALS: Calculator, trundle wheel (or wheel) or round basket

VOCABULARY: Diameter, circumference, revolution, pi (π), inches, feet and mile

PREREQUISITE SKILL: Calculator lesson 23.

LESSON

- **DIRECTED INSTRUCTION/ GUIDED PRACTICE**

  In lesson 23, students discovered circumference divided by diameter equals pi, $C \div d = \pi$. In this lesson they will use the equation, $C = \pi \times d$. This lesson will relate these formulas to the wheels of their bicycles and the distances they travel.

  Teacher rolls a wheel once along a line to demonstrate that CIRCUMFERENCE is the DISTANCE ONE REVOLUTION of the wheel will cover. For example, a wagon wheel with a 10" diameter will roll about 3.14 x 10" = 31.4 inches in one revolution. Pass out Student Activity Sheet.

  Guide students through questions 1-5. Discuss results. See Teacher Answer Sheet.

- **INDEPENDENT PRACTICE:**

  Students complete Student Activity Sheet.

- **HOME EXTENSION ACTIVITY:**

  Hand out Home Activity Sheet and have students compare their results the following day. Answers will vary.

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THE WHEELS ON THE BIKE GO ROUND AND ROUND

Student Activity Sheet
Teacher Answer Sheet

CIRCUMFERENCE = π X d = pi x diameter use 3.14 for π

1. How far will a bicycle with a 20" diameter wheel roll in one revolution ? 62.8
   or about 63 inches
2. There are 5280 feet in one mile. How many inches are in one mile? _____
   63360
3. Estimate how many revolutions the 20" diameter bicycle wheel will make in one mile. 63360 ÷ 63 is about 1,000 revolutions
4. What operation can you use to solve question 3? (÷) divide
5. Use your calculator to solve question 3. Round to the nearest whole number. _____
   63360 ÷ 63 = 1006
6. If you have a bicycle with a 24" diameter wheel, will it take more or less revolutions than the 20" wheel to go one mile? less
7. Find the number of revolutions the 24" bicycle wheel will make in one mile.
   24" x 3.14 = 75 inches 63360 ÷ 75 = 844.8 = 845
8. On a 5 mile bicycle trip, how many revolutions will a 24" bicycle wheel make?
   845 x 5 = 4225
9. Find how many revolutions the 24" bicycle wheel will make on a 10 mile trip. Do this mentally. Record your answer 4225 x 2 = 8450
   Verify with your calculator. (Hint: you can use the answer to problem 7 or 8.)

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NAME _____

THE WHEELS ON THE BIKE GO ROUND AND ROUND
Student Activity Sheet

CIRCUMFERENCE = π X d = pi x diameter use 3.14 for π

1. How far will a bicycle with a 20" diameter wheel roll in one revolution ?

_____

2. There are 5280 feet in one mile. How many inches are in one mile?

_____

3. Estimate how many revolutions the 20" diameter bicycle wheel will make in one mile. _____

4. What operation can you use to solve question 3? _____

5. Use your calculator to solve question 3. Round to the nearest whole number.

_____

6. If you have a bicycle with a 24" diameter wheel, will it take more or less revolutions than the 20" wheel to go one mile? _____

7. Find the number of revolutions the 24" bicycle wheel will make in one mile.

_____

8. On a 5 mile bicycle trip, how many revolutions will a 24" bicycle wheel make?

_____

9. Find how many revolutions the 24" bicycle wheel will make on a 10 mile trip. Do this mentally. Record your answer _____

Verify with your calculator. (Hint: you can use the answer to problem 7 or 8.)

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Name _____

THE WHEELS ON THE BIKE GO ROUND AND ROUND

Home Activity Sheet

$$C = \pi d$$

1. Measure the diameter of a tire on a car in inches. _____

2. Determine the number of revolutions the tire will make in one mile.
   Record _____

3. Tires last about 30,000 miles. How many revolutions would that be?
   _____

4. What other vehicles have larger wheel sizes? _____

5. How would these larger sizes affect the number of revolutions in one mile?

   _____

   _____

   _____

   _____

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WHICH HOLDS MORE?

GRADE: 6

STRAND: Geometry

SKILL: Estimate and find volume of solids.

MANAGEMENT

CLASS ORGANIZATION: Whole class, small groups

TIME FRAME: Two math periods

MATERIALS: Calculator, 8.5" by 11" paper, metric and customary rulers, masking or cellophane tape, different cylindrical containers

VOCABULARY: Volume, circumference, diameter, radius, cylinder

PREREQUISITE SKILL: Understand π and use of formulas

LESSON

DIRECTED INSTRUCTION AND GUIDED PRACTICE:

- Give each student 2 pieces of 8.5 by 11 inch paper and a ruler. With the longer side in a vertical position, curl the paper so you get a hollow cylinder. Tape the edges so they meet but do not overlap. See Figure 1.

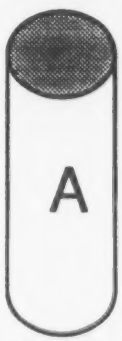

Figure 1

Figure 2

- Students use the other piece of paper and with the shorter side in a vertical position, curl the paper so you get a hollow cylinder. Tape the edges. See Figure 2.
- Hand out Student Activity Sheet 1.
- Students have two different cylinders made from 8.5" by 11" paper.
- Students estimate which holds more.

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Be sure students notice the circumference of cylinder A equals the width of the original paper. The circumference of cylinder B equals the length of the original paper.

- Students measure the diameter of each cylinder and record.
- To find the diameter, students will also use the formula: Circumference ÷ π = d. The circumference for Figure 1 is 8.5". The circumference for Figure 2 is 11".
- Discuss the differences between the answers to questions 2 and 3.
- The radius is $\frac{1}{2}$ of the diameter (.5 x d).
- Volume = $\pi r^2 h$. Volume will be in cubic inches (in^3). The heights of the cylinders are shown in the picture at the top of Student Activity Sheet 1.
- Be sure students have time to compare calculated volumes with their original estimates. Ask them if they repeat the procedure with 2 other matching sheets of paper, "Will the volume of the shorter cylinder always be more?" Explain.

- **INDEPENDENT PRACTICE:**
  - Hand out Student Activity Sheet 2 and metric rulers.
  - Select three different cylindrical containers.
  - Label them A, B, C.
  - Using estimation, order the cylinders from the least to the greatest volume.

Example: volume of B < volume of A < volume of C

Students:

- Measure the diameter of the circular base and the height of each container to the nearest tenth of a cm.
- Compute the radius of each container.
- Record their measurement on Student Activity Sheet 2.
- Find the volume of each container. [V = $\pi r^2 h$]
- Record answers on the Student Activity Sheet.
- Discuss how their estimates compare to the actual volume of each container.

- **HOME ACTIVITY**

  Students measure the diameter and height of 3 cans and use their calculator to find the volume. Record diameter, height, and volume for each can.

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WHICH HOLDS MORE?
Student Activity Sheet 1
Teacher Answer Sheet

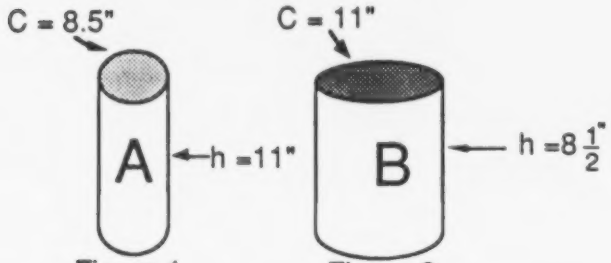

Figure 1 Figure 2

1. Estimate which cylinder holds more. _____

   Note: The circumference of cylinder A equals the width of your original paper. The circumference of cylinder B equals the length of your original paper.

2. Measure the diameter of each cylinder.

   Diameter of cylinder A = about 2 3/4 or 2.75 in.

   Diameter of cylinder B = about 3 1/2 or 3.5 in.

   circumference ÷ π = diameter

3. Use the fomula C ÷ π = d (π = 3.14) to compute the diameter of each cylinder.

   Diameter of cylinder A = 2.707 in.

   Diameter of cylinder B = 3.503 in.

4. Are the answers to questions 2 and 3 approximately the same ? ____

   Answer will vary

   Explain: Using an inch ruler, measurements will be in fractional parts, either fourths, eighths or sixteenths.

5. Radius = Diameter ÷ 2 Use the diameters from question 3 to compute the radii of the cylinders.

   Radius of cylinder A = 1.35 in.

   Radius of cylinder B = 1.75 in.

   VOLUME OF A CYLINDER
   Volume = area of circular base x height of cylinder.
   Volume = π x radius of base x radius of base x height = $\pi r^2 h$

6. Find the volume of the cylinders.

   Volume of cylinder A = 62.94915 cubic in.

   Volume of cylinder B = 81.738125 cubic in.

7. Compare results to your estimate in question 1. Which cylinder holds more? _____

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Name _____

WHICH HOLDS MORE?

Student Activity Sheet 1

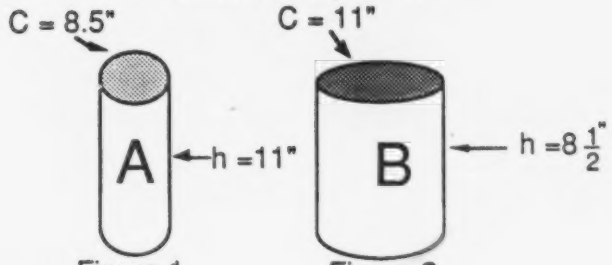

Figure 1 Figure 2

1. Estimate which cylinder holds more. _____

   Note: The circumference of cylinder A equals the width of your original paper. The circumference of cylinder B equals the length of your original paper.

2. Measure the diameter of each cylinder.

   Diameter of cylinder A = _____ in.

   Diameter of cylinder B = _____ in.

   circumference ÷ π = diameter

3. Use the fomula C ÷ π = d (π = 3.14) to compute the diameter of each cylinder.

   Diameter of cylinder A = _____ in.

   Diameter of cylinder B = _____ in.

4. Are the answers to questions 2 and 3 approximately the same ?

   Explain: _____

   _____

5. Radius = Diameter ÷ 2 Use the diameters from question 3 to compute the radii of the cylinders.

   Radius of cylinder A = _____ in.

   Radius of cylinder B = _____ in.

   VOLUME OF A CYLINDER
   Volume = area of circular base x height of cylinder.
   Volume = π x radius of base x radius of base x height = $\pi r^2 h$

6. Find the volume of the cylinders.

   Volume of cylinder A = _____ cubic in. (in^3).

   Volume of cylinder B = _____ cubic in. (in^3).

7. Compare results to your estimate in question 1. Which cylinder holds more? _____

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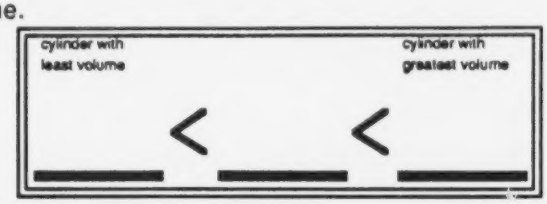
Name _____

WHICH HOLDS MORE?

Student Activity Sheet 2

1. Select three different cylindrical containers.
2. Label them A, B, C.
3. Using estimation, order the cylinders from the least to the greatest volume.



4. Measure the diameter of the circular base and the height of each container. What is the radius of each container?
5. Record your measurement.

	diameter nearest tenth of cm (d)	radius nearest tenth of cm (r)	height nearest tenth of cm (h)
A			
B			
C			

6. Find the volume of each container.

$\pi = 3.14 \quad V = \pi r^2 h$

	$V = \pi r^2 h$
A	
B	
C	

7. How did your estimate compare to the actual volume of each container?

_____

_____

_____

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CHRIS' UP AND DOWN DAY

GRADE: 5 - 6

STRAND: Measurement

SKILL: Apply temperature conversion formulas.

MANAGEMENT

CLASS ORGANIZATION: Whole class

TIME FRAME: One math period

MATERIALS: Calculator, (thermometers optional)

VOCABULARY: Conversion, Fahrenheit, Celsius

PREREQUISITE SKILL: Understanding decimals

LESSON

Activity 1

- **DIRECTED INSTRUCTION:**

  "Today we are going to read a story about Chris and use the story to help us learn about Fahrenheit and Celsius temperatures." Hand out Student Activity Sheet. "There are adjective blanks for you to fill in to describe the temperature, and temperature blanks for you to fill in the conversion of the given Fahrenheit or Celsius temperatures."

  "Use the sheet with the thermometers to estimate your temperatures. Use the words at the top of the worksheet for the adjectives." Students might find it easier to do all the estimating of temperatures before writing the adjectives. Each adjective is used once.

- **GUIDED PRACTICE:**

  Do the first paragraph with the students before they work on their own. Discuss how they can look at the thermometers and estimate the converted temperature.

- **INDEPENDENT PRACTICE:**

  Students estimate the rest of Student Activity Sheet, filling in their answers in the blanks. They will not need their calculators for this part of the period. Give them about 10-15 minutes.

- **EVALUATION:**

  When the Student Activity Sheet is completed, students compare their recorded responses. Discuss any major differences.

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LESSON

Activity 2

- **DIRECTED INSTRUCTION:**

  Hand out a second copy of Student Activity Sheet. Students will use formulas for converting Fahrenheit to Celsius and Celsius to Fahrenheit.

Celsius to Fahrenheit	Fahrenheit to Celsius
C x 9 ÷ 5 + 32 = F	(F - 32) x 5 ÷ 9 = C

  Use calculators to do these conversions.

  Students do the first paragraph. This time using the formulas to find the correct answers for the temperatures. Ask students to compare their estimates with their computed answers.

- **INDEPENDENT PRACTICE:**

  Students complete Student Activity Sheet on their own using the formulas. They check to see how close their estimates were to the computed answer.

- **EVALUATION:**

  Discuss results.

- **HOME ACTIVITY:**

  Students write a creative story problem involving various temperatures using °F and °C. They must have at least ten conversions.

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CHRIS' UP AND DOWN DAY
Student Activity Sheet 2
Teacher Answer Key

Vocabulary Needed for Blanks (Use each adjective once)					
frigid	hot	warm	steaming	sunny	surfing

C x 9 ÷ 5 + 32 = F	(F - 32) x 5 ÷ 9 = C

Chris and his sister Jan woke up Saturday morning and looked out the window and saw it was not a ___sunny___ day. The temperature gauge read 15° C which is ___59 °F___.
#1 adj. #2

Since Chris and Jan had planned to go to the beach later, this wasn't the kind of weather they expected. They had hoped it would be ___surfing___ weather with
#3 adj.

a temperature of 80 °F which is about ___26.7 °C.___
4

Both decided since they couldn't go to the beach, they didn't want to do their Saturday chores either. Chris quickly jumped into bed and groaned loudly,

"Mom, I'm sick today. I bet I have a temperature of 39 °C which is ___102.2 °F___."
#5

Jan exclaimed, " And I have a stomach ache!" Mom came in the room with a thermometer and put it in Chris' mouth. When she took it out later she said, "Why Chris, your temperature is 96° F which is ___35.6 °C___. That's
#6

too low, so you must be sick. I'll go fix you some ___hot___ oatmeal, with a
#7 adj.

temperature of 88° C, which is ___190.4 °F___. That will warm your body so that you
8

can have a normal reading of 98.6° F which is ___37° C___. As Chris lay in bed, he
#9

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daydreamed about being in sunny, warm (#10 adj.) Hawaii, surfing in the 27° C which is

80.6 (#11) °F ocean. Chris certainly didn't want to be in the frigid (#12 adj.)

water near Alaska, with temperatures near 0° C which is 32 (#13) °F. As

Chris was daydreaming, Mom came in again with a steaming (#14 adj.) cup of cocoa

that looked like it must be 110° C which is 230 (#15) °F. While Chris was sipping the cocoa,

the sun came streaming in his window. Jan jumped up and looked at the temperature

gauge. It read 75° F which is 23.9 (#16) °C. "Oh, boy!", Jan and Chris thought, "I bet by afternoon

the water will be around 20° C which is 68 (#17) °F and the beach will be 80° F which

is 26.7 (#18) °C. I'm going to do my chores now so I can go surfing afterward." Mom laughed as

Chris hurried out the door for she knew Chris' temperature had been 37° C which is 98.6 (#19) °F

all along.

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Name _____

CHRIS' UP AND DOWN DAY

Student Activity Sheet

Vocabulary Needed for Blanks (Use each adjective once)					
frig'd	hot	warm	steaming	sunny	surfing

°C x 9 ÷ 5 + 32 = °F

(°F - 32) x 5 ÷ 9 = °C

Chris and his sister Jan woke up Saturday morning and looked out the window and saw it was not a _____ day. The temperature gauge read 15° C which is _____ °F.
#1 adj. #2

Since Chris and Jan had planned to go to the beach later, this wasn't the kind of weather they expected. They had hoped it would be _____ weather with
#3 adj.

a temperature of 80 °F which is about _____ °C.
#4

Both decided since they couldn't go to the beach, they didn't want to do their Saturday chores either. Chris quickly jumped into bed and groaned loudly,

"Mom, I'm sick today. I bet I have a temperature of 39 °C which is _____ °F."
#5

Jan exclaimed, " And I have a stomach ache!" Mom came in the room with a thermometer and put it in Chris' mouth. When she took it out later she said, "Why Chris, your temperature is 96° F which is _____ °C. That's
#6

too low, so you must be sick. I'll go fix you some _____ oatmeal, with a
#7 adj.

temperature of 88° C, which is _____ °F. That will warm your body so that you
8

can have a normal reading of 98.6° F which is _____ °C. As Chris lay in bed, he
#9

daydreamed about being in sunny, _____ Hawaii, surfing in the 27° C which is
#10 adj.

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_____°F ocean. Chris certainly didn't want to be in the _____
#11 #12 adj.

water near Alaska, with temperatures near 0° C which is_____°F. As
#13

Chris was daydreaming, Mom came in again with a _____cup of cocoa
#14 adj.

that looked like it must be 110° C which is_____°F. While Chris was sipping the cocoa,
#15

the sun came streaming in his window. Jan jumped up and looked at the temperature

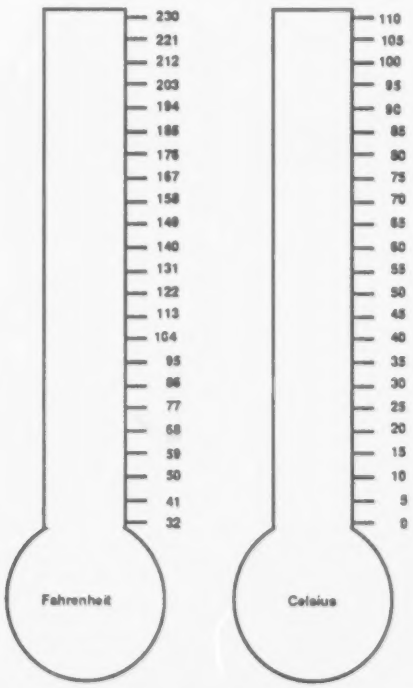
gauge. It read 75° F which is____°C. "Oh, boy!", Jan and Chris thought, "I bet by afternoon
#16

the water will be around 20° C which is_____°F and the beach will be 80° F which
#17

is _____°C. I'm going to do my chores now so I can go surfing afterward." Mom laughed as
#18

Chris hurried out the door for she knew Chris' temperature had been 37° C which is_____°F
#19

all along.



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CHAPTER 3 ASSESSMENT:

MEASUREMENT AND GEOMETRY

1. The width of a dollar bill is 6.5 centimeters. John is 143 centimeters tall. How tall is John in dollar bill widths?

   Student response. 143 ÷ 6.5 = 22 dollar bill widths.

2. Your country creates a new form of money and calls it a glob.

   a. You can receive 3.8 globs for a $1.00. How many dollars can you receive for 19 globs?

   b. Create a chart showing the conversion amounts from dollars to globs for 5, 10, 15, 20, 25, 30, 35, and 40 dollars.

   Student response.
   a. 19 ÷ 3.8 = $5

   b.

Dollars	Globs
5	19
10	38
15	57
20	76
25	95
30	114
35	133
40	152

3. What is the relationship between the total number of degrees of the interior angles of the following polygons?
   Triangle Quadrilateral Pentagon Hexagon

   Student response.

Shape	Total number of degrees of the interior angles
Triangle	180
Quadrilateral	360
Pentagon	540
Hexagon	720

Each time the polygon increases by 1 side the total number of degrees of the interior angles increases by 180°.

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4. Choose three of the following geometric shapes and write a complete definition to describe them:

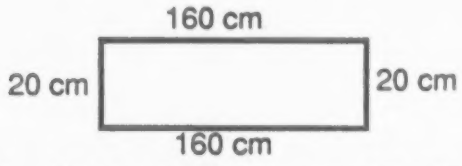
   Scalene triangle, equilateral triangle, isosceles triangle, parallelogram, rhombus, rectangle, trapezoid.

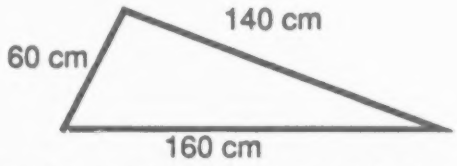
   Student responses will vary as students will use their own language.
   Possible definitions are listed below.

   Scalene triangle - A triangle with 3 unequal sides and 3 unequal angles.
   Equilateral triangle - A triangle with 3 equal sides and 3 equal angles.
   Isosceles triangle - A triangle with 2 equal sides and 2 equal angles.
   Parallelogram - A quadrilateral whose opposite sides are parallel.
   Rhombus - A parallelogram with equal sides.
   Rectangle - A quadrilateral with 4 right angles.
   Trapezoid - A quadrilateral with 2 sides parallel and 2 sides not parallel.

5. Sketch 3 different polygons with perimeters of 360mm. Name the polygons and label their dimensions. The polygons do not have to be drawn to scale.

   Student responses will vary. Some examples are:





6. How many different rectangles with only whole number measurements for length and width can you make using a 24 inch piece of string? Make a chart showing the dimensions of the different rectangles.

   Student response should be 6 different rectangles.

Width	Length	Perimeter
1	11	24
2	10	24
3	9	24
4	8	24
5	7	24
6	6	24

   A 3 by 9 rectangle is not considered different from a 9 by 3 rectangle.

7. Design a swimming pool. Show its dimensions.
   a. Compute the length of fencing you would need to enclose it.
   b. Compute the area of a solar pool cover.

   Student responses will vary.

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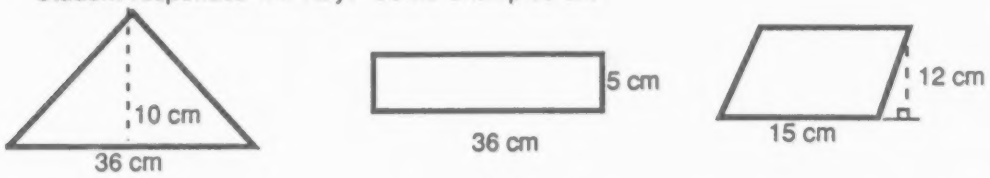
8. Sketch three different polygons with areas of 180 cm^2.
Name the polygons and label their dimensions. The polygons do not have to be drawn to scale.

Student responses will vary. Some examples are:



9. List real-life situations where knowing how to find area or perimeter would be useful.

Student responses may include purchasing a rug, paint, fence, seeds, or wallpaper.

10. If you were an author writing a mathematics textbook, how would you explain area and perimeter?

Student responses should include some mention of distance around in the perimeter explanation. A discussion of area should refer to the amount of space inside the borders of a closed flat figure.

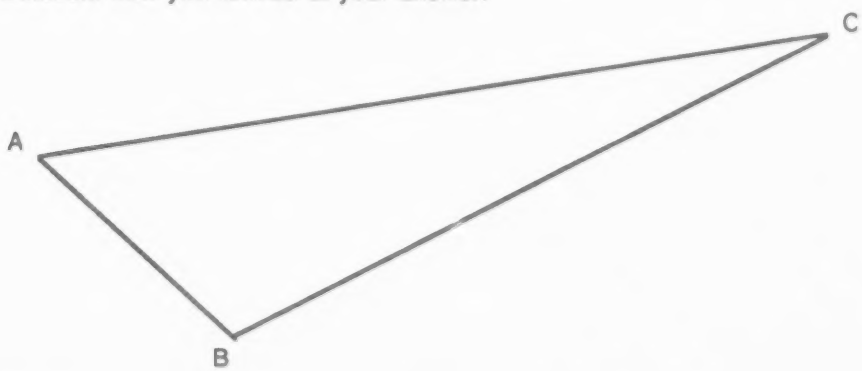
11. Write a word problem using area and another using perimeter. Solve the problems.

Student responses will vary.

12. Measure the length of a shoelace or piece of string. Form the string into a circle. Measure the diameter of the circle created. Use your calculator to compute: length of string ÷ diameter of the circle created. Do this with 3 different length strings and record your results. Compute the average of your results. Write what you observe about your results.

Student responses will vary, but they all should have approximately 3.1 for an answer.

13. a. Find the area of the following triangle in square centimeters.
b. Describe how you arrived at your answer.



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Student responses will vary because of the inaccuracies of measurement. They should use A = .5 x base x height and measure to find the height. Answers should range between 18 to 20.

14. a. If the diameter of a jar is 8.5 cm, what is the circumference?
    b. Find the diameter of a circle if the circumference is 78.25 cm? (round to the nearest tenth of a cm)

Student response:

a. $c = \pi d = 3.14 \times 8.5 = 26.69$ cm^2
b. $d = c \div \pi = 78.25 \div 3.14 = 24.9$ cm (nearest tenth)

15. Steve is riding a bicycle with 24 inch diameter wheels on a 17 mile trip. Answer the questions below:

Needed Information

12 inches = 1 foot
5280 feet = 1 mile

a. How many feet long is the diameter of the wheel?
b. How many feet long is the circumference of the wheel?
c. How many feet long is the bicycle trip?
d. How many revolutions will the bicycle wheel make during the trip?

Student responses:

a. 24 inches = 2 feet
b. $c = 3.14 \times 2 = 6.28$ feet
c. $17 \times 5280 = 89760$ feet
d. Revolutions = $\frac{\text{distance}}{\text{circumference}} = \frac{89760}{6.28} = 14292.993 \approx 14293$ completed revolutions.

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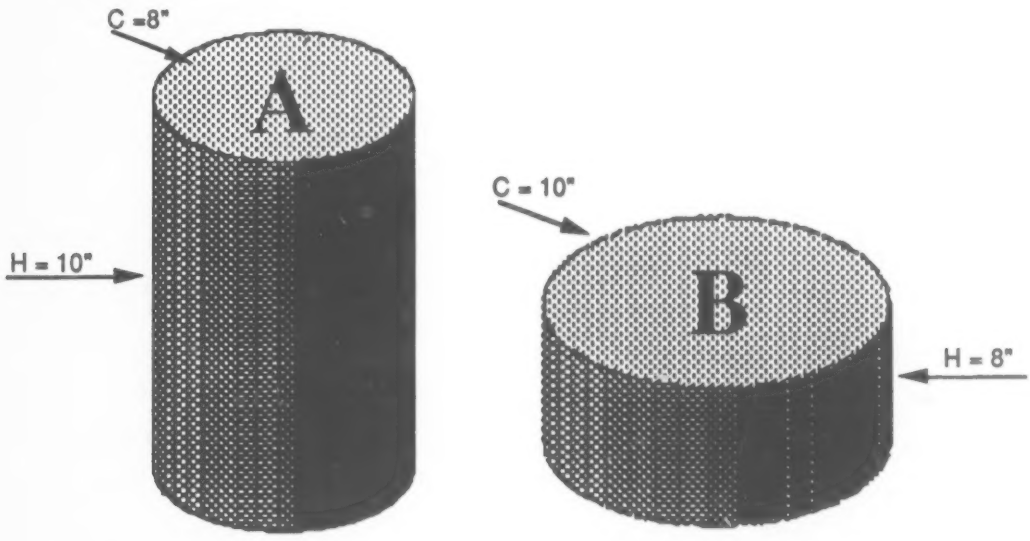
16. An 8 inch by 10 inch paper has been folded two different ways to form a cylinder. Which one will have the greater volume? Show your work. (Round quotients to the nearest hundredth.)

$C \div \pi = d$	$d \div 2 = r$	$V = \pi r^2 h$



Student responses:
Figure A
$C = 8$ in
$d = C \div \pi = 8 \div 3.14 = 2.548$ in
$r = 2.548 \div 2 = 1.274 = 1.27$ in
$V = \pi r^2 h = 3.14\ (1.27)^2\ (10) = 50.6\ in^3$

Figure B
$C = 10$ in
$d = C \div \pi = 10 \div 3.14 = 3.185$ in
$r = 3.185 \div 2 = 1.59$ in
$V = \pi r^2 h = 3.14\ (1.59)^2\ (8) = 63.51\ in^3$

Figure B has the greater volume.

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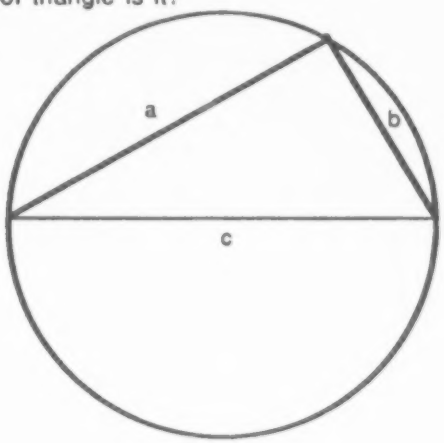
17. Measure the lengths of sides a, b, and c. What is the relationship between a^2, b^2, and c^2? What kind of triangle is it?



Student response:
It is a right triangle because $a^2 + b^2 = c^2$. Note: Because of the inaccuracies involved in measurement, $a^2 + b^2$ may not appear to be exactly equal to c^2.

18. Use the following formulas to convert Fahrenheit into Celsius (Centigrade) and Celsius into Fahrenheit. (F - 32) x 5 ÷ 9 = C and C x 9 ÷ 5 + 32 = F (Round to the nearest degree.)

72 degrees Fahrenheit = _____ Celsius
72 degrees Celsius = _____ Fahrenheit

Student responses:

C = (F - 32) x 5 ÷ 9
C = (72 - 32) x 5 ÷ 9
C = 40 x 5 ÷ 9
C = 200 ÷ 9
C = 22.2°

F = C x 9 ÷ 5 + 32
F = 72 x 9 ÷ 5 + 32
F = 648 ÷ 5 + 32
F = 129.6 + 32
F = 161.6°

19. Write a set of "I Have, Who Has" cards for concepts you learned from Measurement or Geometry lessons. Be sure no two cards have the same answer.

Student responses will vary.

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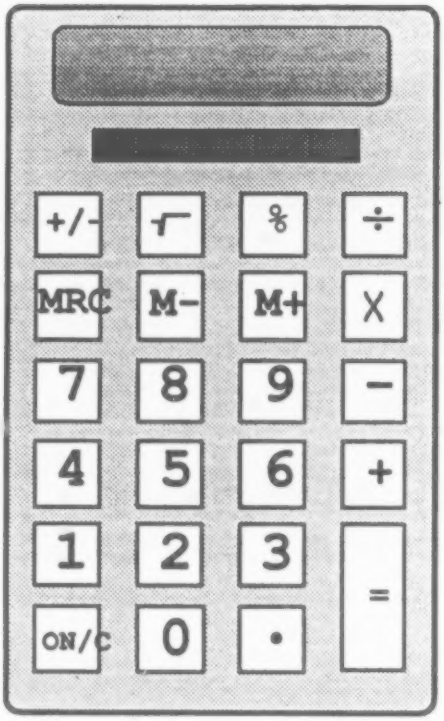
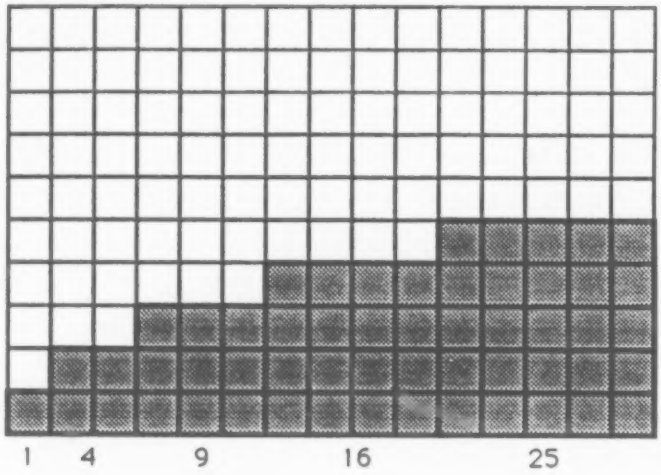
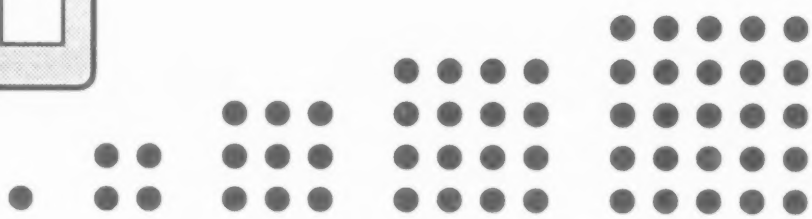
CAMP-LA

Calculators and Mathematics Project, Los Angeles







Grades 5 - 6

CHAPTER 4
NUMBER/ ALGEBRA

LEFTOVERS

GRADE: 5 - 6

STRAND: Number

SKILL: Find division remainders using a calculator
Interpret remainders.

MANAGEMENT

CLASS ORGANIZATION: Pairs or whole class

TIME FRAME: One math period

MATERIALS: Calculator

VOCABULARY: Dividend, divisor, quotient

PREREQUISITE SKILL: Understanding of division algorithm

LESSON

- **DIRECTED INSTRUCTION:**

  Students learn how to use a calculator to do whole number division problems, and obtain a whole number remainder. They will apply this skill to solve word problems.

> **To use a calculator to find remainders in division of whole numbers problems:**
>
> 1. Divide using the calculator.
> 2. Write down the whole number part of your answer. (Leave off the decimal part.)
> 3. Multiply the whole number part of your quotient by the divisor.
> 4. Subtract this result from the dividend.
> 5. The result should be your remainder.

Example: $26\overline{)837}$

a. 837 ÷ 26 shows 32.192307 on the calculator
b. Record the 32
c. Multiply 32 x 26 = 832
d. Subtract 832 from 837 837 - 832 = 5
e. So $26\overline{)837} = 32\ R\ 5$ (32 remainder 5)

- **GUIDED PRACTICE:**

  Hand out Student Activity Sheet.
  Do problem 1: 825 ÷ 37 = Check for understanding.

  1. 825 ÷ 37 shows as 22.297297
  2. The whole number part is 22.
  3. 22 x 37 = 814
  4. 825 - 814 = 11
  5. So $37\overline{)825} = 22$ R 11

- **INDEPENDENT PRACTICE:**

  Complete Student Activity Sheet.

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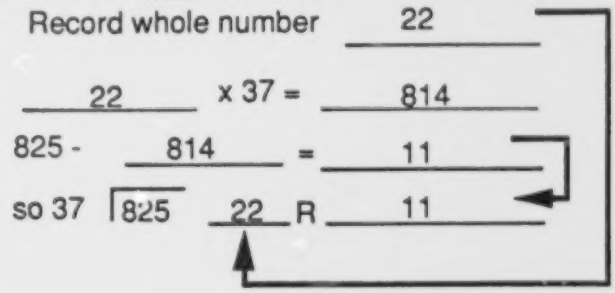
LEFTOVERS
Student Activity Sheet
Teacher Answer Sheet

1. Use a calculator to compute the quotient as a whole number and remainder. 825 ÷ 37 = 22.297297 on the calculator.



Use your calculator to find answers to the following problems:

2. John Walksalot decided to walk 2000 miles across the United States. If he walks 23 miles a day, how many full days will it take him 86, and how many miles will he have to walk on his last day? 22

3. Fido's doghouse is being eaten by termites. If his house is made up of 1600 cubic inches of wood, and the termites eat 7 cubic inches a day. How many full days will the termites eat? 228 How many cubic inches will be left for the last day? 4

4. John Hasitwrong ordered buses for the field trip. Each bus holds 67 students. 800 people needed to go on the field trip. He divided 800 ÷ 67. His calculator showed 11.940298 so he ordered 11 buses. How many students were left at school? 63

5. Mr. Principal bought pizzas to reward his students for being wonderful. He bought 399 pizzas and had them each cut into 6 pieces. If each student eats 4 pieces, how many students could be fed? 598 How many pieces would be left over? 2

6. Write and answer your own word problem using division and a whole number remainder. Record the solution.

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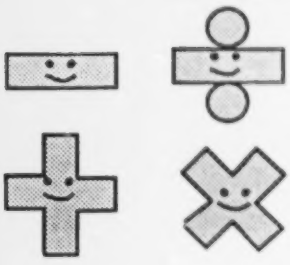
Name _____

LEFTOVERS
Student Activity Sheet

1. Use a calculator to compute the quotient as a whole number and remainder. 825 ÷ 37 = _____ on the calculator.



Record whole number _____

_____ x 37 = _____

825 - _____ = _____

so 37 ⟌825 ____ R _____

Use your calculator to find answers to the following problems.

2. John Walksalot decided to walk 2000 miles across the United States. If he walks 23 miles a day, how many full days will it take him_____, and how many miles will he have to walk on his last day?_____

3. Fido's doghouse is being eaten by termites. If his house is made up of 1600 cubic inches of wood, and the termites eat 7 cubic inches a day. How many full days will the termites eat? _____ How many cubic inches will be left for the last day? _____

4. John Hasitwrong ordered buses for the field trip. Each bus holds 67 students. 800 people needed to go on the field trip. He divided 800 ÷ 67. His calculator showed 11.940298 so he ordered 11 buses. How many students were left at school? _____

5. Mr. Principal bought pizzas to reward his students for being wonderful. He bought 399 pizzas and had them each cut into 6 pieces. If each student eats 4 pieces, how many students could be fed? _____ How many pieces would be left over?_____

6. Write and answer your own word problem using division and a whole number remainder. Record the solution.

_____

_____

_____

_____

_____

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GUINNESS EGGSCEPTIONAL FACTS

GRADE 5 - 6

STRAND: Number

SKILL: Solve story problems from real life situations

MANAGEMENT

CLASS ORGANIZATION: Small group

TIME FRAME: One math period

MATERIALS: Calculator

VOCABULARY: Dozen

PREREQUISITE SKILL: Customary measures (in., ft., yd., lb., oz.)

LESSON

- **DIRECTED INSTRUCTION:**

  Tell your students they will be discovering interesting facts about eggs. Write the following fact on the board. They can use a calculator for the computations.

  Fact: The longest distance for throwing a fresh hen's egg without breaking it is 317 feet 10 inches.

  Discuss converting feet to inches by multiplying by 12. Ask how many inches the hen's egg was thrown. Check to see that everyone understands that it is (317 x 12) + 10 = 3814 inches.

- **GUIDED PRACTICE:**

  Ask the class to find how many yardsticks laid end to end would cover the distance the egg was thrown. Check to see that they do. (3814 ÷ 36 = 105.94444). Mention that since it is bigger than 105, 106 must be the correct number of yardsticks.

- **INDEPENDENT PRACTICE:**

  Groups complete Student Activity Sheet.

- **EVALUATION:**

  Groups discuss how they solved the problems on the Student Activity Sheet.

- **HOME ACTIVITY:**

  There are many types of animals that lay eggs. Research an interesting fact about eggs. Write one or more facts and a mathematics question using the information you found. Be sure to write the answer to your question.

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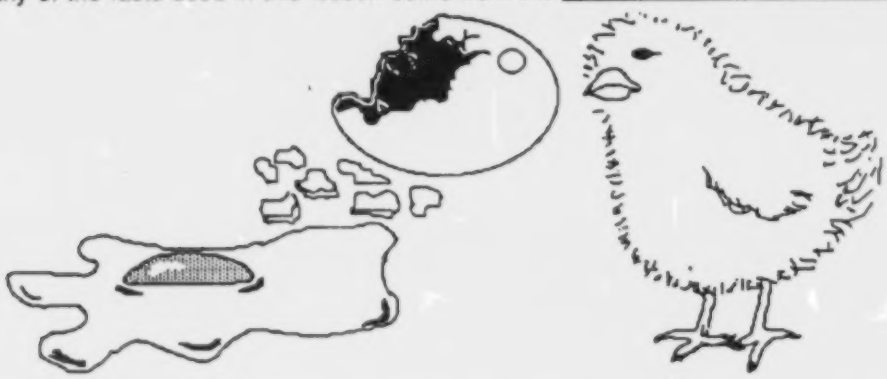
GUINNESS EGGSCEPTIONAL FACTS

Teacher Answer Sheet

Many of the facts used in this lesson come from the Guinness Book of World Records, 1987 edition.



1. Fact: A typical chicken will lay 22 eggs per month on the average.
   Question: At this rate, how many eggs will a chicken lay in a year? 264
   How did you get this answer? 22 x 12 (months in a year)

2. Fact: The largest omelet ever produced was one made of 45,000 chicken eggs on January 27, 1986.
   Question: How many dozen eggs is this? 3750
   What would be the cost to make this omelet if eggs sell for $.99 a dozen? $3712.50
   How many years would it take a typical chicken to lay enough eggs to make this omelet? 170.45454 or about $170\frac{1}{2}$ years
   Since chickens don't live this long, how many chickens would you need to produce the 45,000 eggs in a year? 171

3. Fact: The minimum weight per dozen large eggs (set by the U.S. Government) is 24 oz.
   Question: About how much do 45,000 large eggs weigh? 90,000 oz. or 5625 pounds.

4. Fact: The greatest number of 2-egg omelets made by 1 person in $\frac{1}{2}$ hour is 315.
   Question: How many dozen eggs would you need to purchase if you wanted to duplicate this record? To get 52.5 or $52\frac{1}{2}$ dozen eggs you need to purchase 53 dozen.
   How many eggs would be left over? 6

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GUINNESS EGGSCEPTIONAL FACTS

Teacher Answer Sheét

5. Fact: The largest bird eggs are produced by ostriches. Their eggs average about 3.75 pounds each.

   Question: How many ounces does this weigh? [16 ounces = 1 pound] 60 ounces

6. Fact: The smallest egg produced by a bird is that of the Vervain hummingbird. It weighs 0.0128 ounces.

   Question: How many times heavier is the ostrich egg than the hummingbird egg? 4687.5

7. Fact: Fish also lay eggs. The ocean sunfish produces 300,000,000 eggs in a single spawning. Each egg measures about 0.05 inches in diameter.

   Question: If you could line up these eggs end to end, how many inches long would this be? 15,000,000 inches

   How many feet long would this be? [12 inches = 1 foot] 1,250,000 feet

   How many miles long would these eggs stretch? [5280 feet = 1 mile] 236.74242 miles

- **HOME ACTIVITY:**

There are many types of animals that lay eggs. Research an interesting fact about eggs. Write one or more facts and a mathematics question using the information you found. Be sure to write the answer to your question.

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Name _____

GUINNESS EGGSCEPTIONAL FACTS
Student Activity Sheet

Many of the facts used in this lesson come from the Guinness Book of World Records, 1987 edition.

1. Fact: A typical chicken will lay 22 eggs per month on the average.
   Question: At this rate, how many eggs will a chicken lay in a year? _____
   How did you get this answer? _____

2. Fact: The largest omelet ever produced was one made of 45,000 chicken eggs on January 27, 1986.
   Question: How many dozen eggs is this? _____
   What would be the cost to make this omelet if eggs sell for $.99 a dozen? _____
   How many years would it take a typical chicken to lay enough eggs to make this omelet? _____
   Since chickens don't live this long, how many chickens would you need to produce the 45,000 eggs in a year? _____

3. Fact: The minimum weight per dozen large eggs (set by the U.S. Government) is 24 oz.
   Question: About how much do 45,000 large eggs weigh? _____

4. Fact: The greatest number of 2-egg omelets made by 1 person in $\frac{1}{2}$ hour is 315.
   Question: How many dozen eggs would you need to purchase if you wanted to duplicate this record? _____
   How many eggs would be left over? _____

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GUINNESS EGGSCEPTIONAL FACTS
Student Activity Sheet

5. Fact: The largest bird eggs are produced by ostriches. Their eggs average about 3.75 pounds each.

   Question: How many ounces does this weigh? [16 ounces = 1 pound] _____

6. Fact: The smallest egg produced by a bird is that of the Vervain hummingbird. It weighs 0.0128 ounces.

   Question: How many times heavier is the ostrich egg than the hummingbird egg? _____

7. Fact: Fish also lay eggs. The ocean sunfish produces 300,000,000 eggs in a single spawning. Each egg measures about 0.05 inches in diameter.

   Question: If you could line up these eggs end to end, how many inches long would this be? ___

   How many feet long would this be? [12 inches = 1 foot] _____

   How many miles long would these eggs stretch? [5280 feet = 1 mile] _____

• **HOME ACTIVITY:**

There are many types of animals that lay eggs. Research an interesting fact about eggs. Write one or more facts and a mathematics question using the information you found. Be sure to write the answer to your question.

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EZ MILLION TRIVIA PURSUIT

GRADE: 5 - 6

STRAND: Number

SKILL: Use whole numbers in problem situations

MANAGEMENT

CLASS ORGANIZATION: Pairs or small groups

TIME FRAME: Two or three math periods

MATERIALS: Calculator

VOCABULARY: Trivia, million, ream, equivalent

PREREQUISITE SKILL: Experience working with large numbers.

LESSON

- **DIRECTED INSTRUCTION:**

  Think of the number 1,000,000. Will it fit on the calculator?
  Hand out Student Activity Sheet 1.
  The first problem solving situation should be done by the teacher with the class.

  1. If your family were to win a $1,000,000 lottery, tax free, and collect $200 a week, how long would it take to collect the full amount?
     - Estimate the number of weeks.
     - Estimate the number of years.
     - Compute the actual amounts.
     - Answer: 5000 weeks ≈ 96.153846 ≈ 96 years

- **GUIDED PRACTICE:**

  2. Pretend you are a banker and can count $1 bills at the rate of one hundred per minute. If you work six hours a day, how long would it take you to count $1,000,000? How many people would be needed to complete this task in one working day (counting at the same rate)?
     - Estimate how long it would take.
     - Estimate the number of people needed.
     - Compute the actual amounts.
     - Answer: 100 per minute x 60 minutes = $6000 per hour.
       $6000 x 6 hours = $36,000 per day.
       How long: 1,000,000 ÷ 36,000 ≈ 27.77... ≈ 28 days
       People: 28 people working 1 day.

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- **INDEPENDENT PRACTICE:** (Answers are rounded.)
  Hand out and have students complete Student Activity Sheets 2-4.

3. A. If a car travels 65 miles per hour for 24 hours a day. How long would it take to complete a journey of 1,000,000 miles?

   Answer: 65 miles x 24 hours = 1560 miles per day
   1,000,000 ÷ 1560 = 641 days, or 1 year and 276 days.

   B. If the car in problem A traveled only 55 miles per hour, how long would it take?

   Answer: 55 miles x 24 hours = 1320 miles per day
   1,000,000 ÷ 1320 = 758 days or 2 years and 28 days.

   C. How long would it take a car traveling, 8 hours each day at 65 miles per hour, to complete a journey of 1,000,000 miles?

   Answer: 65 miles x 8 hours = 520 miles per day
   1,000,000 ÷ 520 = 1923 days or 5 years and 98 days.

   D. How long would it take a car traveling, 8 hours each day at 55 miles per hour, to complete a journey of 1,000,000 miles?

   Answer: 55 x 8 hours = 440 miles per day
   1,000,000 ÷ 440 = 2273 days or 6 years and 83 days.

4. A ream of typing paper contains 500 sheets of paper. How many reams of paper are needed to assemble 1,000,000 sheets? If the reams were placed in a single stack, and each ream is 2 inches thick, then how high would a million pieces of paper be?

   Answer: 1,000,000 sheets ÷ 500 sheets = 2,000 reams
   2,000 reams x 2 inches = 4,000 inches

   If each ream is about 5 cm thick, then how many meters high would the stack be?

   Answer: 2,000 reams x 5 cm = 10,000 cm
   10,000 cm ÷ 100 cm = 100 meters

   If a flagpole is 45 feet high, then how many flagpoles high would 1,000,000 pieces of paper be? Estimate first.

   Flagpole: 45 feet or 540 inches
   1,000,000 pieces (4000 inches) would be a little more than 7 flag poles.

5. The Ancient Romans defined a mile as the length of 1000 paces. Each pace is the distance covered walking forward two steps. If a man's pace is about $2\frac{1}{2}$ feet long, then how long would a million paces be?

   Answer: $2\frac{1}{2}$ x 1,000,000 = 2,500,000 feet
   2,500,000 feet ÷ 5280 feet in a mile = 473 miles

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6. A dollar bill is about 6 inches long and $2\frac{1}{2}$ inches wide. If you place dollar bills end to end in a straight line, how many dollar bills would it take to cover a distance of 1,000,000 inches? 1,000,000 inches is equivalent to how many miles?

   Answer: 1,000,000 inches ÷ 6 inches = 166,667 bills
   1,000,000 inches ÷ 12 inches in a foot = 83,333 feet
   83,333 feet ÷ 5280 ft in a mile = 16 miles

- **EXTENSION:**
  Hand out Student Activity Sheet 5. Discuss. Students make a rough estimate first then gather data for a better estimate. How many sheets of paper are used by your class each year? By your school?
  Note: How many sheets are used by a class each day? A week?
  Remember there are 500 sheets in a ream of paper.

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Name _____

EZ MILLION TRIVIA PURSUIT
Student Activity Sheet 1

Directions: Discuss each problem with your group and plan the best way to solve it. Estimate first. Compute the actual amounts.

1. If your family were to win a $1,000,000 lottery, tax free, and would collect $200 a week, how long would it take to collect the full amount? Estimate the number of weeks. Estimate the number of years.

	Weeks	Years
Estimate		

	Weeks	Years
Actual		

2. Pretend you are a banker and can count one dollar bills at the rate of one hundred per minute. If you work six hours a day, how long would it take you to count $1,000,000? How many people would be needed to complete this task in one working day (counting at the same rate)? Estimate how long it would take. Estimate the number of people needed. Compute the actual amounts.

	How long	How many people
Estimate		

	How long	How many people
Actual		

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Name _____

EZ MILLION TRIVIA PURSUIT
Student Activity Sheet 2

Directions:

Read the following problem. Record your estimates on the chart below then solve. (Round answers to the nearest day)

3. A. If a car travels 65 miles per hour for 24 hours a day. How long would it take to complete a journey of 1,000,000 miles?

B. If the car in problem A traveled only 55 miles per hour, how long would it take?

C. How long would it take a car traveling, 8 hours each day at 65 miles per hour, to complete a journey of 1,000,000 miles?

D. How long would it take a car traveling, 8 hours each day at 55 miles per hour, to complete a journey of 1,000,000 miles?

TIME TO DRIVE 1,000,000 MILES				
			ESTIMATE	ACTUAL
	Hours Driving Per Day	Miles Per Hour	Years and Days	Years and Days
A	24 hour per day	65		
B	24 hour per day	55		
C	8 hours per day	65		
D	8 hours per day	55		

How did you find the actual number of years and days from the given information?

_____

_____

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Name _____

EZ MILLION TRIVIA PURSUIT
Student Activity Sheet 3

4. A ream of typing paper contains 500 sheets of paper. How many reams of paper are needed to assemble 1,000,000 sheets? If the reams were placed in a single stack, and each ream is 2 inches thick, then how high would a million pieces of paper be?

_____reams _____inches

If each ream is about 5 cm thick, then how many meters high would the stack be? _____meters

If a flagpole is 45 feet high, then how many flagpoles high would 1,000,000 pieces of paper be? Estimate first.

Estimate	How many flag poles?

Actual	How many flag poles?

5. The Ancient Romans defined a mile as the length of 1000 paces. Each pace is the distance covered walking forward two steps. If a man's pace is about $2\frac{1}{2}$ feet long, then how long would a million paces be?

Estimate	One pace	Million paces	÷ 5280 ft	= miles
	$2\frac{1}{2}$ feet			

Actual	One pace	Million paces	÷ 5280 ft	= miles
	$2\frac{1}{2}$ feet			

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Name _____

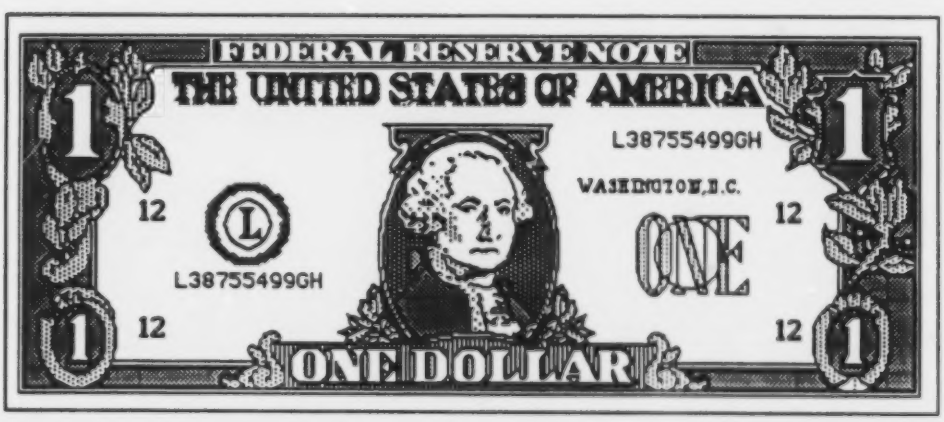
EZ MILLION TRIVIA PURSUIT
Student Activity Sheet 4

6. A dollar bill is about 6 inches long and $2\frac{1}{2}$ inches wide. If you place dollar bills end to end in a straight line, how many dollar bills would it take to cover a distance of 1,000,000 inches?

Estimate	How many dollar bills?
Actual	How many dollar bills?

1,000,000 inches is equivalent to how many miles?

Estimate	How many miles?
Actual	How many miles?



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NAME _____

EZ MILLION TRIVIA PURSUIT
Student Activity Sheet 5

Directions: Discuss each problem with your group and plan the best way to solve it. Estimate first. Then gather data and compute an improved estimate.

How many sheets of paper are used by your class each year? By your school? Estimate first.

Note: How many sheets are used by a class each day?
A week?
Remember there are 500 sheets in a ream of paper.

Original estimate.

	Estimate	Sheets per day	Sheets per week	Sheets per year	Reams
Class					
School					

Improved estimate based on gathered data.

	Estimate based on gathered data	Sheets per day	Sheets per week	Sheets per year	Reams
Class					
School					

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GET THE POINT?

GRADE: 5 - 6

STRAND: Number

SKILL: Multiply decimals

MANAGEMENT

CLASS ORGANIZATION: Individual or pairs

TIME FRAME: One math period

MATERIALS: Calculator

VOCABULARY: Decimal places, digit

PREREQUISITE SKILL: Multiplication of whole numbers

LESSON

- **DIRECTED INSTRUCTION & GUIDED PRACTICE:**

  This is a discovery lesson to teach multiplication of decimals and the limitations of a calculator display. Students complete Student Activity Sheet 1 to discover generalizations about placement of the decimal point.

  Generalization:

Count the number of digits to the right of the decimal points in the factors. There must be that many digits to the right of the decimal point in the product.

  If nobody comes up with the generalization, lead them to it using the answers on Student Activity 1.

- **INDEPENDENT PRACTICE:**

  Students complete Student Activity Sheet 2, part A. Discuss placement of the decimal point and zeros in each product.

  Student complete Activity Sheet 2, part B.

  Teacher Note: Students discover that extra digits to the right of decimal points are dropped when decimal numbers overfill the display. This gives an incorrect answer for these problems. Discuss with your class that calculators have limitations when numbers with too many decimal places are used.

- **EVALUATION:**

  Teacher observation.

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GET THE POINT
Student Activity Sheet 1
Teacher Answer Sheet

Find the following products with your calculator and record your results. Try to determine the placement of the decimal point. Check your answer with the calculator. Determine a rule to correctly place the decimal in any multiplication problem.

1) 12345 x 4321 = 53342745	2) 12345 x 432.1 = 5334274.5	3) 1234.5 x 4321 = 5334274.5	4) 12345 x 43.21 = 533427.45
5) 1234.5 x 432.1 = 533427.45	6) 123.45 x 4321 = 533427.45	7) 12345 x 4.321 = 53342.745	8) 1234.5 x 43.21 = 53342.745
9) 123.45 x 4.321 = 533.42745	10) 12.345 x 4321 = 53342.745	11) 12345 x .4321 = 5334.2745	12) 1234.5 x 4.321 = 5334.2745
13) 123.45 x 43.21 = 5334.2745	14) 12.345 x 432.1 = 5334.2745	15) 1.2345 x 4321 = 5334.2745	16) .12345 x 4321 = 533.42745

Write your rule for the placement of the decimal point?_____

_____

_____

_____

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GET THE POINT?
Student Activity Sheet 2
Teacher Answer Sheet

A. Keep in mind the results of Activity Sheet 1 and predict the product. Solve using the calculator.

1) 2 x .3 = .06

2) 0.02 x 3 = .06

3) 2 x .03 = .06

4) 0.02 x .3 = .006

5) 0.02 x .03 = .0006

6) .002 x .003 = .000006

7) .12 x .2 = .024

8) .012 x .2 = .0024

9) .012 x .02 = .00024

10) .0012 x .002 = .0000024

B. With your group, look at the problems below. Decide and record the correct products, then do the problems with the calculator. Check to see if your products are correct. **WHAT HAPPENED? WHY?**

.00012 x .0002	.00003 x .0003	.000007 x .0001	.0000022 x .2
.000000024	.000000009	.0000000007	.00000044

Answers

0	0	0	0

Calculator Answers

Why? Most calculators will only write the first eight decimal digits.

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Name _____

GET THE POINT

Student Activity Sheet 1

Find the following products with your calculator and record your results. Try to determine the placement of the decimal point. Check your answer with the calculator. Determine a rule to correctly place the decimal in any multiplication problem.

1) 12345 x 4321	2) 12345 x 432.1	3) 1234.5 x 4321	4) 12345 x 43.21
5) 1234.5 x 432.1	6) 123.45 x 4321	7) 12345 x 4.321	8) 1234.5 x 43.21
9) 123.45 x 4.321	10) 12.345 x 4321	11) 12345 x .4321	12) 1234.5 x 4.321
13) 123.45 x 43.21	14) 12.345 x 432.1	15) 1.2345 x 4321	16) .12345 x 4321

Write your rule for the placement of the decimal point? _____

_____

_____

_____

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Name _____

GET THE POINT

Student Activity Sheet 2

A. Keep in mind the results of Activity Sheet 1 and predict the product. Solve using the calculator.

1) .2 x .3

2) 0.02 x 3

3) 2 x .03

4) 0.02 x .3

5) 0.02 x .03

6) .002 x .003

7) .12 x .2

8) .012 x .2

9) .012 x .02

10) .0012 x .002

B. With your group, look at the problems below. Decide and record the correct products, then do the problems with the calculator. Check to see if your products are correct. **WHAT HAPPENED? WHY?**

.00012 x .0002	.00003 x .0003	.000007 x .0001	.0000022 x .2
_____	_____	_____	_____
Answers			
_____	_____	_____	_____
Calculator Answers			

What happened? _____

_____

Why? _____

_____

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DIGITAL REACTION

GRADE: 5 - 6

STRAND: Number

SKILL: Multiply or divide decimals by 10, 100, or 1,000

MANAGEMENT

CLASS ORGANIZATION: Whole class

TIME FRAME: One math period

MATERIALS: Calculator, 2 copies of Place Value Chart per student

VOCABULARY: Digit

PREREQUISITE SKILL: Place value

LESSON

TEACHER NOTE: This lesson should be used before or as an alternative to a textbook lesson on multiplication or division by 10, 100, 1000.

- **DIRECTED INSTRUCTION: GUIDED AND INDEPENDENT PRACTICE**

1. Hand out Student Activity Sheet 1 and Place Value Chart.

   Have students complete the sheet. Discuss their observations. In the discussion stress the following concepts:
   - Multiplication by **10**, places all digits one place value column to the left.
   - Multiplication by **100**, places all digits two place value columns to the left.
   - Multiplication by **1000**, places all digits three place value columns to the left.

2. Hand out Student Activity Sheet 2 and another copy of the place value chart. Have students complete the sheet. Discuss their observations. In the discussion stress the following concepts:
   - Division by **10**, places all digits one place value column to the right.
   - Division by **100**, places all digits two place value columns to the right.
   - Division by **1000**, places all digits three place value columns to the right.

- **EVALUATION:**

  Student verbal and written responses.

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PLACE VALUE CHART - Teacher Answer Key - Multiplication

	Millions	Hundred Thousands	Ten Millions	Ten Thousands	Thousands	Hundreds	Tens	Ones	Tenths	Hundredths	Thousandths	Ten - Thousandths	Hundred - Thousandths	Millionths	Ten - Millionths
1						7	4	5.	9	6	8	5			
					7	4	5	9.	6	8	5				
2						1	5	6.							
					1	5	6	0.							
3						3	7	5.	4	2					
					3	7	5	4.	2						
4								0.	0	7	6				
								0.	7	6					
5							7	5.	0	0	8				
						7	5	0.	0	8					
6						1	5	6.							
				1	5	6	0	0.							
7						3	7	5.	4	2					
				3	7	5	4	2.							
8								0.	0	7	6				
								7.	6						
9						7	4	5.	9	6	8	5			
				7	4	5	9	6.	8	5					
10							7	5.	0	0	8				
					7	5	0	0.	8						
11						3	7	5.	4	2					
			3	7	5	4	2	0.							
12								0.	0	7	6				
							7	6.							
13							7	5.	0	0	8				
				7	5	0	0	8.							

PLACE VALUE CHART

Teacher Answer Key - Division

	Millions	Hundred Thousands	Ten Millions	Ten Thousands	Thousands	Hundreds	Tens	Ones	Tenths	Hundredths	Thousandths	Ten - Thousandths	Hundred - Thousandths	Millionths	Ten - Millionths
1						7	4	5.	9	6	8	5			
							7	4.	5	9	6	8	5		
2						1	5	6.							
							1	5.	6						
3						3	7	5.	4	2					
							3	7.	5	4	2				
4								0.	0	7	6				
								0.	0	0	7	6			
5							7	5.	0	0	8				
								7.	5	0	0	8			
6						1	5	6.							
								1.	5	6					
7						3	7	5.	4	2					
								3.	7	5	4	2			
8								0.	0	7	6				
								0.	0	0	0	7	6		
9						7	4	5.	9	6	8	5			
								7.	4	5	9	6	8	5	
10							7	5.	0	0	8				
								0.	7	5	0	0	8		
11						3	7	5.	4	2					
								0.	3	7	5	4	2		
12								0.	0	7	6				
								0.	0	0	0	0	7	6	
13							7	5.	0	0	8				
								0.	0	7	5	0	0	8	

Name _____

DIGITAL REACTION

Student Activity Sheet 1

A	B	C
Enter the numbers in the place value chart and proceed to columns B and C.	Predict what number would result when multiplying the number in column A by 10. Write your prediction.	Multiply the number in column A by 10 on your calculator and write the result here and in the place value chart.
1) 745.9685		
2) 156.		
3) 375.42		
4) .076		
5) 75.008		

Examine the numbers on the place value chart. Describe what happens to the digits in a number when it is multiplied by 10. _____

Enter the numbers in the place value chart and proceed to columns B and C.	Predict what number would result when multiplying the number in column A by 100 Write your prediction.	Multiply the number in column A by 100 on your calculator and write the result here and in the place value chart.
6) 156.		
7) 375.42		
8) .076		
9) 745.9685		
10) 75.008		

Examine these numbers on the place value chart. Describe what happens to the digits in a number when it is multiplied by 100. _____

Enter the number in the place value chart and proceed to columns B and C.	Predict what number would result when multiplying the number in column A by 1000. Write your prediction.	Multiply the number in column A by 1000 on your calculator and write the result here and in the place value chart.
11) 375.42		
12) .076		
13) 75.008		

Examine these numbers on the place value chart. Describe what happens to the digits in a number when it is multiplied by 1000. _____

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Name _____

DIGITAL REACTION
Student Activity Sheet 2

A	B	C
Enter the number in the place value chart and proceed to columns B and C.	Predict what number would result when dividing the number in column A by 10 Write your prediction.	Divide the number in column A by 10 on your calculator and enter the result on the place value chart.
1) 745.9685		
2) 156		
3) 375.42		
4) .076		
5) 75.008		

Examine the place value chart. Describe what happens to the digits in a number when it is divided by 10. _____

Enter the number in the place value chart and proceed to columns B and C.	Predict what number would result when dividing the number in column A by 100 Write your prediction.	Divide the number in column A by 100 on your calculator and enter the result here and on the place value chart.
6) 156		
7) 375.42		
8) .076		
9) 745.9685		
10) 75.008		

Predict what will happen if you multiply a number by 1000 _____

Examine the place value chart. Describe what happens to the digits in a number when it is divided by 100. _____

Enter the number in the place value chart and proceed to columns B and C.	Predict what number would result when dividing the number in column A by 1000 Write your prediction.	Divide the number in column A by 1000 on your calculator and enter the result here and on the place value chart.
11) 375.42		
12) .076		
13) 75.008		

Examine the place value chart. Describe what happens to the digits in a number when it is divided by 1000. _____

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DIGITAL REACTION **PLACE VALUE CHART**

	Millions	Hundred Thousands	Ten Millions	Ten Thousands	Thousands	Hundreds	Tens	Ones	Tenths	Hundredths	Thousandths	Ten - Thousandths	Hundred - Thousandths	Millionths	Ten - Millionths
1								.							
								.							
2								.							
								.							
3								.							
								.							
4								.							
								.							
5								.							
								.							
6								.							
								.							
7								.							
								.							
8								.							
								.							
9								.							
								.							
10								.							
								.							
11								.							
								.							
12								.							
								.							
13								.							
								.							

WHAT WOULD YOU WEIGH ON MARS?

GRADE: 5 - 6

STRAND: Number

SKILL: Multiply decimals, estimate products.

MANAGEMENT

CLASS ORGANIZATION: Pairs

TIME FRAME: One math period

MATERIALS: Calculator, bathroom scale

VOCABULARY: Gravitation, factors, product

PREREQUISITE SKILL: Multiplication of decimals

LESSON

- **DIRECTED INSTRUCTION:**

  The same object will have different weights on different planets due to the force called gravity.
  To find the weight of someone on the moon multiply their weight on earth by 0.17. If John weighs 90 pounds on earth, use your calculator to find his weight on the moon.

  Think: What are the two factors to be multiplied?

  90 x 0.17 = 15.3 pounds

- **GUIDED PRACTICE:**

  Hand out Student Activity Sheet 1 and have students do the first problem. Verify their answers before they continue independently.

  NOTE:

  On most calculators this can be done with the **constant function.** Press 6.5 x .38 = to find the baby's weight on Mercury. DO NOT CLEAR THE CALCULATOR 6.5 will remain in the calculator as a multiplication constant. To find the weight on Venus, press .89 [=]. Continue pressing each planet's gravitational factor number and [=] to complete Mars and Jupiter.

  Students will then estimate the baby's weight on the other planets. They do this with a partner and complete problem 2.

- **INDEPENDENT PRACTICE:**

  Activity Sheet 2. Have students weigh themselves on the bathroom scale. Students complete Activity Sheet 2 and share results with a partner.

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WHAT WOULD YOU WEIGH ON MARS?
Student Activity Sheet 1
Teacher Answer Sheet

To find what an object would weigh on different planets we multiply its weight on earth by the following gravitational factors.

Mercury	0.38
Venus	0.89
Mars	0.38
Jupiter	2.5
Saturn	1.1
Uranus	0.8
Neptune	1.2
Pluto	0.01

1. If a newborn baby weighs 6.5 pounds on earth, find its weight on the following planets: (Use your calculator and its constant function)

Mercury	2.47 lbs
Venus	5.785 lbs
Mars	2.47 lbs
Jupiter	16.25 lbs

2. Estimate the baby's weight on the following planets. Discuss your estimate with your partner and record. Then use your calculator and record the exact weight.

	Estimate	Calculated weight
Saturn	_____	7.15 lbs
Uranus	_____	5.2 lbs
Neptune	_____	7.8 lbs
Pluto	_____	.065 lbs

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WHAT WOULD YOU WEIGH ON MARS?
Student Activity Sheet 2
Teacher Answer Sheet

RECORD YOUR WEIGHT_____

Mercury	0.38
Venus	0.89
Mars	0.38
Jupiter	2.5
Saturn	1.1
Uranus	0.8
Neptune	1.2
Pluto	0.01

1. On which planet would you weigh the most? Jupiter

   How much would you weigh? Answer will vary

2. On which planet would you weigh the least? Pluto

   How much would you weigh? Answer will vary

3. On which planet would you weigh about the same as you do on earth? Saturn

   How much would you wiegh? Answer will vary

4. On which two planets will your weight be almost the same?

   There are two possible answers. Saturn and Neptune because the gravitional factors are close (1.1 & 1.2). Mercury and Mars is also a possible answer because the .38 listed for both is a rounded number.

5. If your weight on Mars is 38 pounds what would you weigh on earth? 100 lbs

6. If a 90 pound boy weighs 2,520 pounds on the sun what is the gravitational factor of the sun? 28

   How do you get this? 2520 ÷ 90

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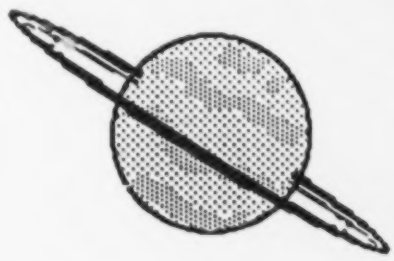
Name_____

WHAT WOULD YOU WEIGH ON MARS?

Student Activity Sheet 1

To find what an object would weigh on different planets we multiply its weight on earth by the following gravitational factors.

Mercury	0.38
Venus	0.89
Mars	0.38
Jupiter	2.5
Saturn	1.1
Uranus	0.8
Neptune	1.2
Pluto	0.01



1. If a newborn baby weighs 6.5 pounds on earth, find its weight on the following planets: (Use your calculator and its constant function.)

   Mercury _____

   Venus _____

   Mars _____

   Jupiter _____

2. Estimate the baby's weight on the following planets. Discuss your estimate with your partner and record. Then use your calculator and record the exact weight.

	Estimate	Calculated weight
Saturn	_____	_____
Uranus	_____	_____
Neptune	_____	_____
Pluto	_____	_____

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Name _____

WHAT WOULD YOU WEIGH ON MARS?

Student Activity Sheet 2

RECORD YOUR WEIGHT_____

Mercury	0.38
Venus	0.89
Mars	0.38
Jupiter	2.5
Saturn	1.1
Uranus	0.8
Neptune	1.2
Pluto	0.01

1. On which planet would you weigh the most? _____

   How much would you weigh? _____

2. On which planet would you weigh the least? _____

   How much would you weigh?_____

3. On which planet would you weigh about the same as you do on earth?_____

   How much would you wiegh? _____

4. On which two planets will your weight be almost the same?

   _____

   Why?_____

   _____

5. If your weight on Mars is 38 pounds what would you weigh on earth?_____

6. If a 90 pound boy weighs 2,520 pounds on the sun what is the gravitational factor of the sun?_____

   How do you get this?_____

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BUTCHER MATH

GRADE: 5 - 6

STRAND: Number

SKILL: Multiply and divide decimals.

MANAGEMENT

CLASS ORGANIZATION: Whole class or pairs

TIME FRAME: One math period

MATERIALS: Calculator

VOCABULARY: Net weight (wt.), price per pound (lb.), total price, factor, almost equal symbol (≈)

PREREQUISITE SKILL: Round to the nearest hundredth

LESSON

- **DIRECTED INSTRUCTION:**

In this lesson you use information from grocery store labels. You will estimate answers to help determine the arithmetic operation to use. You will use calculators for the actual computation. You will develop formulas to apply to similar situations.

Draw a label that lists net weight, price per pound, and total price using the numbers in the chart below.

Note: Markets round net weight and money to the nearest hundredth.

The teacher will cover up the total price and ask students to estimate the covered amount.

BEEF LOIN TOP SIRLOIN		
Net Weight	Price per lb.	Total Price
1.51 lb	$2.49	$3.76

1lb. cost: $2.49 ≈ $2.50
2 lb. cost: about $5.00

1.5 lb. would cost: between $3 and $4.

Think about the mathematical operation and process you would use to calculate the total price.
Would you add, subtract, multiply or divide 1.51(net weight) and $2.49 (price per pound) to get the total price?

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Try it with 1.51(lbs.) and 2.49 (price/lb.) on your calculator.
Find the total price.
What answer did you get?
What formula shows how to find total price when we know net weight and price per lb.? Remember to round amounts to the nearest hundredth.

Net weight x price per lb. = total price 1.51 x $2.49 = 3.76

3.7599 rounds to $3.76

- **GUIDED PRACTICE:**
  Hand out Student Activity Sheet 1. Students will answer the questions with their partners as teacher observes and assists as needed. Students will verify answers with their calculator. Discuss and correct student answers.

- **INDEPENDENT PRACTICE:**
  Hand out and have students complete Student Activity Sheet 2.

- **HOME ACTIVITY:**
  Find 4 food labels (fish, meat, cheese) that include net weight, price per pound, and total price. Bring in the labels or copy the information (including name of the item) on the blanks provided. Fill in the amounts and verify their accuracy with your calculator.

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BUTCHER MATH
Student Activity Sheet 1
Teacher Key

Example

1.

Look at the label above.

1. The net wt. is 5.4 lb
2. The price per lb. is $1.59
3. The total price is $8.59

4. Write the number sentence and formula you would use with net wt. and price per lb. to get the total price 5.4 lbs. x $1.54/lb. = $8.59

   net wt. x price per pound = total price

5. Write the number sentence and formula you would use if you knew the total price and net wt. and wanted to find the price per lb.

   $8.59 ÷ 5.4 lbs. = $1.59/lb.

   Total price ÷ net weight = price per pound

6. Write the number sentence and formula you would use if you knew the total price and the price per lb. and wanted to find the net wt. $8.59 ÷ $1.59 lb. = 5.4 lbs.

   Total price ÷ price per pound= net weight

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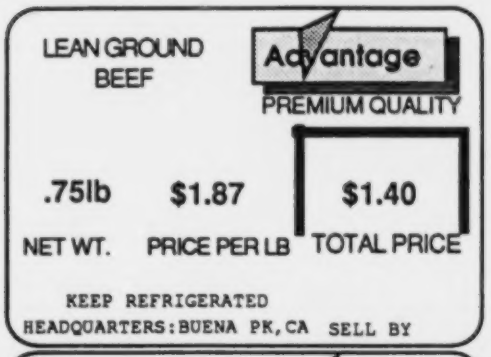
BUTCHER MATH
Student Activity Sheet 2
Teacher Answer Sheet
Use the appropriate formulas from #4, 5, 6 on Sheet 1 to complete the labels.

1.



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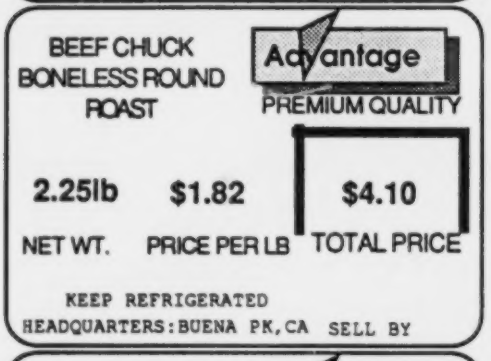

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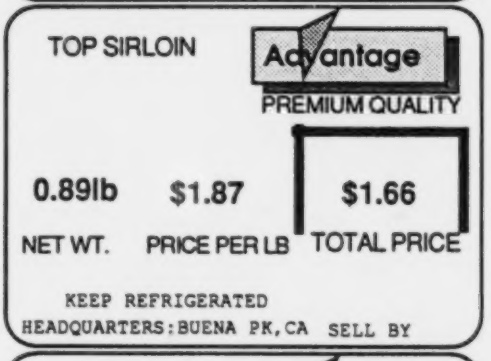

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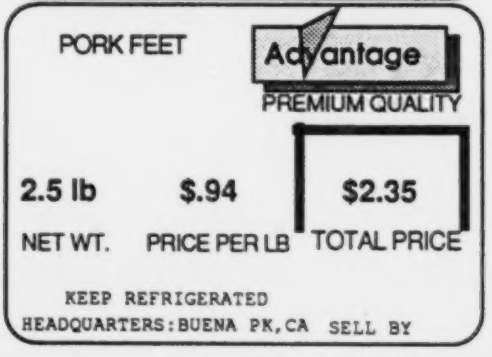

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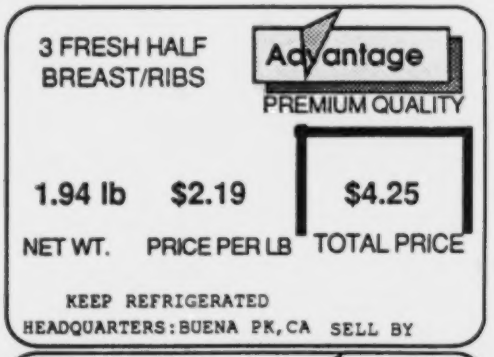

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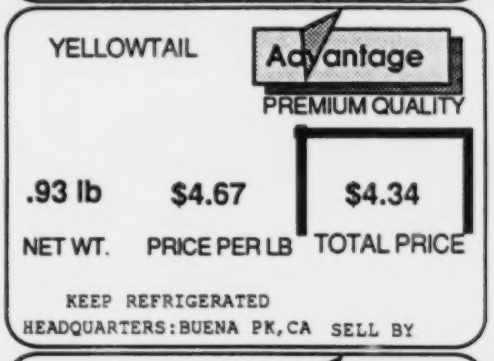

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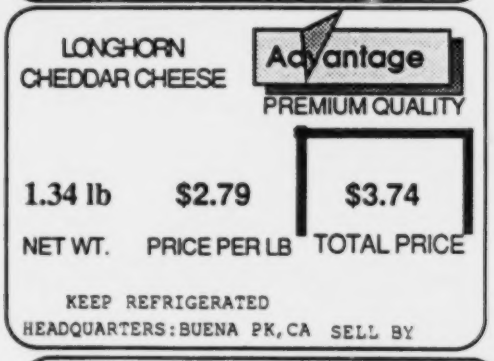

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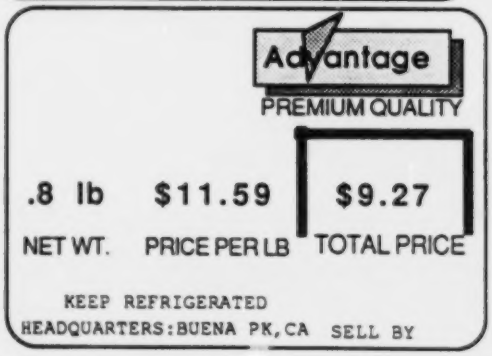

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Name _____

BUTCHER MATH
Student Activity Sheet 1

Example

1.

Look at the label above.

1. The net wt. is _____
2. The price per lb. is _____
3. The total price is _____
4. Write the number sentence and formula you would use with net wt. and price per lb. to get the total price. _____

   _____
5. Write the number sentence and formula you would use if you knew the total price and net wt. and wanted to find the price per lb.

   _____

   _____
6. Write the number sentence and formula you would use if you knew the total price and the price per lb. and wanted to find the net wt. _____

   _____

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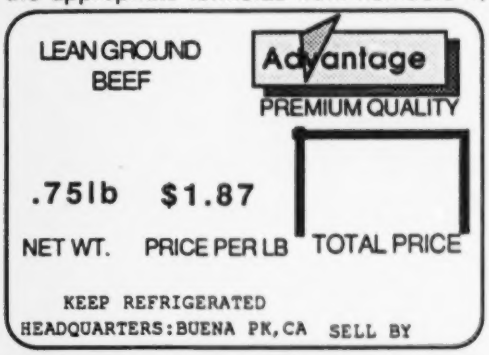
Name _____

BUTCHER MATH

Student Activity Sheet 2

Use the appropriate formulas from numbers 4, 5, 6 on sheet 1 to complete the labels.

1.



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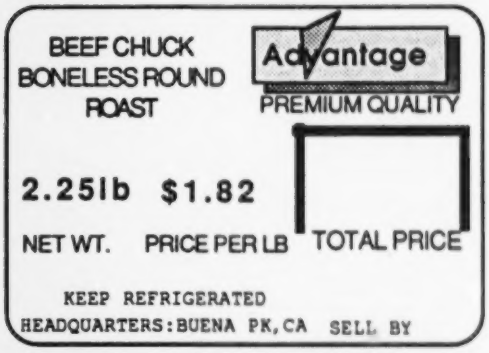

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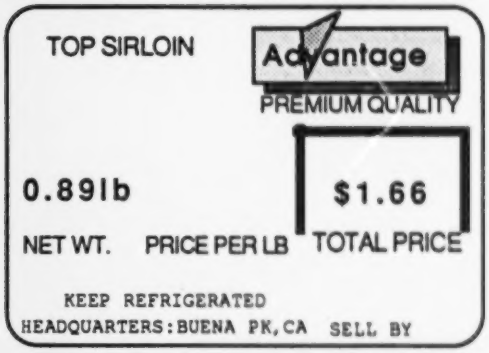

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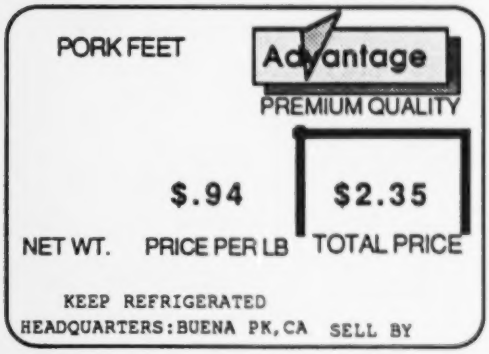

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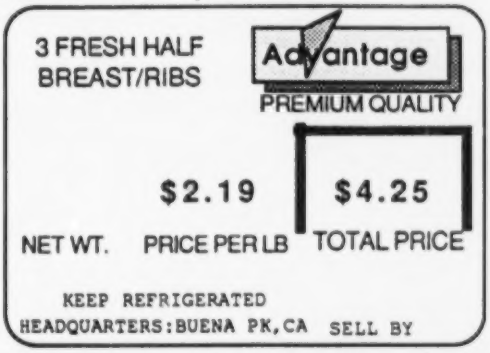

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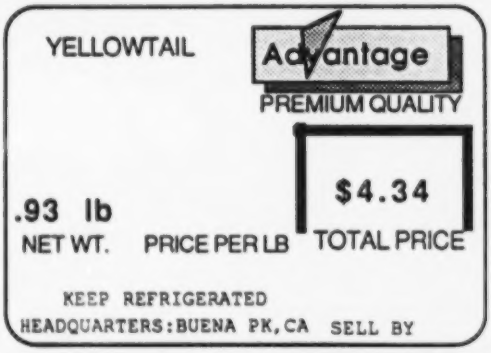

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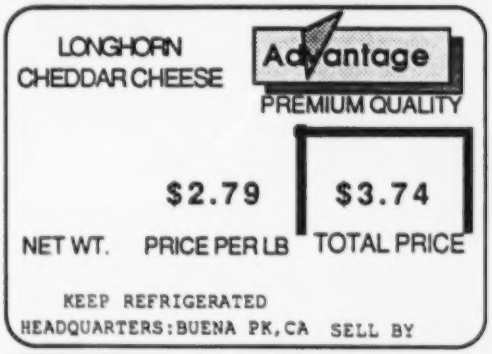

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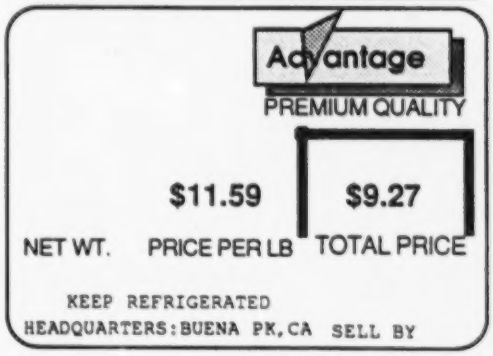

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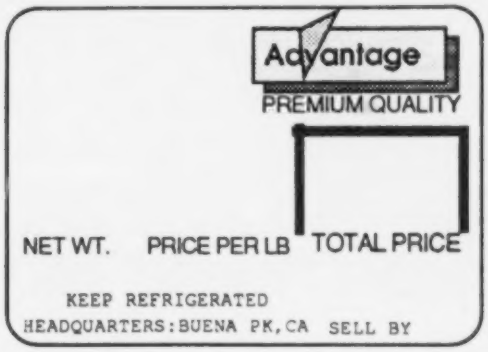
Name _____

BUTCHER MATH
Home Activity Sheet

Find 4 labels on foods that include net weight, price per pound, and total price. Copy the information on the blanks provided. Verify their accuracy with your calculator.

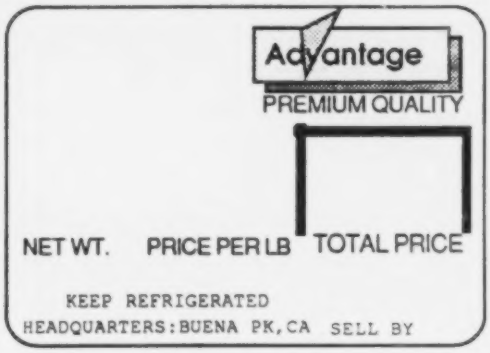
1.



Verify

_____

2.



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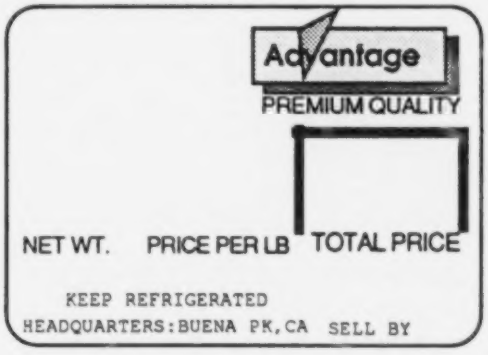

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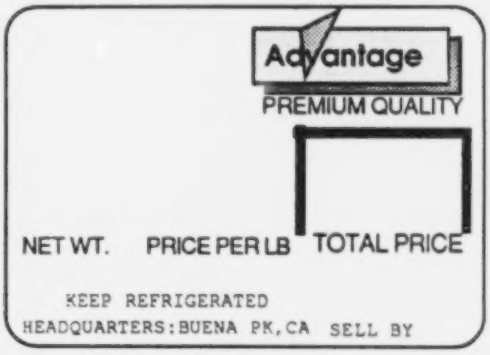

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GET THE BEST BUY

GRADE: 5 - 6

STRAND: Number

SKILL: Multiply or divide numbers involving money
Solve story problems of real life situations using a calculator

MANAGEMENT

CLASS ORGANIZATION: Individual or small group

TIME FRAME: One math period

MATERIALS: Calculator, Student Activity Sheet

VOCABULARY: Best buy, price per unit

PREREQUISITE SKILL: Round decimal numbers

LESSON

- **DIRECTED INSTRUCTION:**

  Discuss: price per unit means cost of 1 unit. It is found by computing: total cost ÷ number of units. Round quotients to the nearest penny (hundredth of a dollar).

  Examples:
  A 12 oz. jar of jam selling for $1.69 costs 1.69 ÷12 = 0.1408333 which rounds to $0.14 per ounce.

  A 16 oz. jar of jam selling for $1.89 costs 1.89 ÷ 16 = 0.118125 which rounds to $0.12 per ounce. The 16 oz. jar is a better buy by $0.14 -$0.12 = $0.02 per ounce.

- **GUIDED PRACTICE:**

  Store A has a 28 oz. jar of peanut butter on sale for $2.99. Store B has an 18 oz. jar of peanut butter on sale for $1.79.

  Students use calculators to find the unit price at store A and store B. Tell which is a better buy, and find the approximate amount of savings per unit.
  Check to see that they do the following:
  Store A: $2.99 ÷ 28 = 0.0167857 rounds to $0.11 per ounce.
  Store B: $179 ÷ 18 = 0.0994444 rounds to $0.10 per ounce.
  Store B is a better buy.
  Store B saves you about $0.11 - $0.10 = $0.01 per ounce.

- **INDEPENDENT PRACTICE:**

  Do Student Activity Sheet

- **EVALUATION:** Student Activity Sheet

- **HOME ACTIVITY:**

  Select 10 items at the market. Record their price and their weight, size, or quantity. Use your calculator to find their unit price. (Examples; price per ounce, price per candy bar, price per piece of gum) Record your results.

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GET THE BEST BUY
Teacher Answer Sheet

Unit price means: Price for 1 unit, it is found by

Price ÷ number of units

- Use your calculator to find unit prices.
- Round your answers to the nearest cent.
- Fill in the chart

	Store A			Store B		
Item	Size	Price	Unit Price (round to the nearest cent)	Size	Price	Unit Price (round to the nearest cent)
Apple Juice	64 oz.	1.29	.02	48 oz.	.99	.02
Barbecue Sauce	18 oz.	.99	.06	19 oz.	1.49	.08
Pineapple Juice	40 oz.	1.69	.04	20 oz.	.75	.04
Salad Dressing	12 oz.	1.49	.12	16 oz	1.99	.12
Potato Chips	7 oz.	.99	.14	16 oz.	1.79	.11
Batteries	4 (pkg)	1.59	.40	4 /(pkg)	1.89	.47
Soda	32 oz.	.99	.03	32 oz.	1.49	.05
Chicken	5 pieces	4.12	.82	8 pieces	6.80	.85
Steak	2.5 lbs	7.55	3.02	1.2 lbs	4.20	3.50
Chocolate bars	6 bars	4.22	.70	4 bars	2.60	.65

Item	Less expensive store (rounded unit price)	Approximate amount of savings per unit
Apple Juice	same	.00
Barbecue Sauce	Store A	.02
Pineapple Juice	same	.00
Salad Dressing	same	.00
Potato Chips	Store B	.03
Batteries	Store A	.07
Soda	Store B	.07
Chicken	Store A	.03
Steak	Store A	.48
Chocolate bars	Store B	.05

Is the largest size always the best buy? no

Is it worth it to drive to a store that has more best buys? What other factors are important in choosing where to shop? Transportation expense to store. Value to you of time expended. Selection of items available in the store: Convenience, etc.

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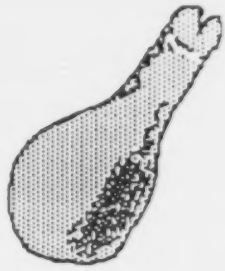
GET THE BEST BUY

Student Activity Sheet

Unit price means: price for 1 unit. It is found by:

Unit Price = Price ÷ number of units

- Use your calculator to find unit prices.
- Round your answers to the nearest cent.
- Fill in the chart.



	Store A			Store B		
Item	Size	Price	Unit Price (round to the nearest cent)	Size	Price	Unit Price (round to the nearest cent)
Apple Juice	64 oz.	1.29		48 oz.	.99	
Barbecue Sauce	18 oz.	.99		19 oz.	1.49	
Pineapple Juice	40 oz.	1.69		20 oz.	.75	
Salad Dressing	12 oz.	1.49		16 oz	1.99	
Potato Chips	7 oz.	.99		16 oz.	1.79	
Batteries	4 (pkg)	1.59		4 (pkg)	1.89	
Soda	32 oz.	.99		32 oz.	1.49	
Chicken	5 pieces	4.12		8 pieces	6.80	
Steak	2.5 lbs	7.55		1.2 lbs	4.20	
Chocolate bars	6 bars	4.22		4 bars	2.60	

Item	Less expensive store (using rounded unit price)	Approximate amount of savings per unit
Apple Juice		
Barbecue Sauce		
Pineapple Juice		
Salad Dressing		
Potato Chips		
Batteries		
Soda		
Chicken		
Steak		
Chocolate bars		

Is the largest size always the best buy?_____

Is it worth it to drive to a store that has more best buys? What other factors are important in choosing where to shop? _____

_____

_____

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POPCORN BALL SHOP

GRADE: 5 - 6

STRAND: Number

SKILL: Use decimals, fractions, basic operations in a problem solving situation.

MANAGEMENT

CLASS ORGANIZATION: Small groups

TIME FRAME: One class period

MATERIALS: Calculator

VOCABULARY: Gross profit, net profit

PREREQUISITE SKILL: Basic operation with decimal numbers

LESSON

- **DIRECTED INSTRUCTION:**
  - Tell each group of four they are going to open a Popcorn Ball Shop.
  - Hand out Student Activity Sheet 1.
  - Students go over the charts and answer the questions.

- **GUIDED PRACTICE:**
  - Hand out Student Activity Sheet 2
  - Help students determine how to increase their profits. Answer will vary.

- **INDEPENDENT PRACTICE:**
  - Hand out Student Activity Sheet 3.
  - Groups make decisions involving increased costs, amount of popcorn balls to make, and profits. Answer will vary.

- **EVALUATION:**
  Each group will share their plan and tell how they are going to make a success of their business.

- **HOME ACTIVITY:**
  Do research to create a list of other products they could sell in their business.

  Example: Lemonade

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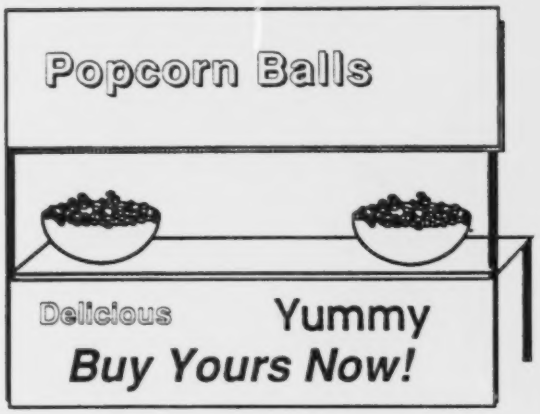
POPCORN BALL SHOP
Teacher Answer Sheet 1



Important Facts:
Costs for One Day

Item	Amount	Expense
Popcorn	2 lbs.	$1.59
Caramels	1 lb.	$1.79
Booth Rental	per day	$2.00
Signs & Posters	Each	.25

Recipe
$\frac{1}{2}$ cup unpopped corn makes 6 cups of popped corn
1 lb. unpopped corn fills 16 half-cups of unpopped corn
1 lb. caramels for every 2 lbs. of unpopped corn
Use 1 cup of popped corn for each popcorn ball

Problems:

1. Using 2 lbs. of unpopped corn and 1 lb. of caramels, how many popcorn balls can you make?

   6 cups popped x 16 half-cups unpopped = 96 cups popped corn for 1 lb.

   2 x 96 cups = 192 cups for 2 lbs. Makes 192 popcorn balls.

2. If you sold all the popcorn balls for ten cents each, then what is your income?

   192 balls at 10¢ = $19.20

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3. What are your expenses? (Assume booth rental for 1 day and 1 sign.)

Popcorn	$1.59
Caramel	$1.79
Booth Rental	$2.00
Signs and Posters	.25
Total	$5.63

4. What is your net profit?

$19.20 - $ 5.63 = $13.57

5. What is your cost for each popcorn ball?

$5.63 ÷ 192 = 0.0293229 rounds to $.03

6. What is your net profit for each popcorn ball?

$13.57 ÷ 192 = 0.070677 or $.07

7. What happens to your profit if you double your recipe? Triple your recipe?

Double Recipe:		Triple Recipe:	
192 x 2 =	384 balls	192 x 3 =	576 balls
384 x 10¢ =	$38.40	576 x 10¢ =	$57.60
Expenses $1.59 x 2 =	$3.18	Expenses $1.59 x 3 =	$4.77
1.79 x 3 =	3.58	1.79 x 3 =	5.37
2.00 =	2.00	2.00 =	2.00
.25 =	.25	25 =	.25
	$9.01		$12.39

Net Profit $38.40 - 9.01 = $29.39

Cost $9.01 ÷ 384 = .0234635

or

Profit per ball $29.39 ÷ 384 = 0.0765364 rounds to $.08

Net Profit $57.60 - 12.39 = $45.21

Cost $12.39 ÷ 576 = 0.0215104

or

Profit per ball $45.21 ÷ 576 = 0.0784895 rounds to $.08

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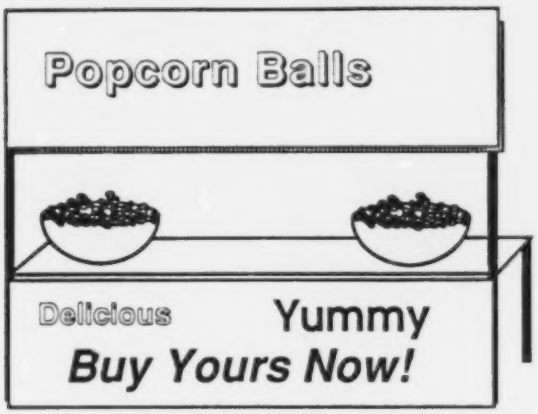
POPCORN BALL SHOP
Student Activity Sheet 1



Important Facts:
Costs for One Day

Item	Amount	Expense
Popcorn	2 lbs.	$1.59
Caramels	1 lb.	$1.79
Booth Rental	a day	$2.00
Signs & Posters	Each	.25

Recipe
$\frac{1}{2}$ cup unpopped corn makes 6 cups of popped corn
1 lb. unpopped corn fills 16 half-cups of unpopped corn
1 lb. caramels for every 2 lbs. of unpopped corn
Use 1 cup of popped corn for each popcorn ball

Problems:

1. Using 2 lbs. of unpopped corn and 1 lb. of caramels, how many popcorn balls can you make?

_____

_____

2. If you sold all the popcorn balls for ten cents each, then what is your income?

_____

_____

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3. What are your expenses? (Assume 1 booth rental for 1 day and 1 sign.)

Popcorn _____

Caramel _____

Booth Rental _____

Signs and Posters _____

Total _____

4. What is your net profit?

_____

5. What is your cost for each popcorn ball?

_____

6. What is your net profit for each popcorn ball?

_____

7. What happens to your profit if you double your recipe? Triple your recipe?

_____

_____

_____

_____

Double Recipe:	Triple Recipe:

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POPCORN BALL SHOP
Student Activity Sheet 2

Change your selling price, use the chart below to compute your profit.

BUSINESS INCOME AND EXPENSE STATEMENT

Number of Popcorn Balls	Selling Price per Popcorn Ball	Total Income	Total Expenses	Cost per Popcorn Ball	Net Profit per Popcorn Ball	Total Net Profit
192						
192						
192						
192						
192						
192						

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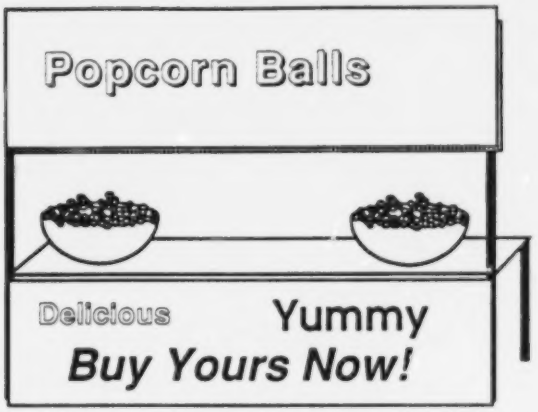
Name _____

POPCORN BALL SHOP
Student Activity Sheet 3



Change the number of popcorn ball batches made, the number of booths, signs and posters, or your selling price. Record how this changes your profit. Use the chart below.

BUSINESS INCOME AND EXPENSE STATEMENT

Number of Popcorn Balls	Selling Price per Popcorn Ball	Total Income	Total Expenses	Cost per Popcorn Ball	Net Profit per Popcorn Ball	Total Net Profit
192						
Double Recipe						
Triple Recipe						
192						
192						
192						

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WATCH YOUR MONEY GROW

GRADE: 5 - 6

STRAND: Number

SKILL: Use powers and multiples of powers to explore large numbers.

MANAGEMENT

CLASS ORGANIZATION: Pairs

TIME FRAME: One or two math periods

MATERIALS: Calculator

VOCABULARY: Millions, thousands

PREREQUISITE SKILL: Place value

LESSON

- **DIRECTED INSTRUCTION:**

  Tell students the purpose of this lesson is to discover how rapidly numbers grow through multiplication. Give students Student Activity Sheet 1. Read the situation with your class. Everyone records an estimate and completes the worksheet.

  Note: The constant function of the calculator may be used in this activity. For example, on Student Activity Sheet 1 you may press 2 x 1===...

  Discuss students' results and comments.

- **INDEPENDENT PRACTICE:**

  Hand out Student Activity Sheet 2. Working in pairs, students complete the worksheet. Discuss results with the class.

  Hand out Student Activity Sheet 3. Working in pairs, students complete the worksheet. Discuss results with the class.

  Hand out Home Activity. Encourage Students to do the activity with their parents.

- **EVALUATION:**
  Teacher observation and Student Activity Sheets.

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WATCH YOUR MONEY GROW
Student Activity Sheet 1
Teacher Answer Sheet

Somebody gives you a magic dollar. It is magic because every night it doubles so that the next day instead of one dollar you have two magic dollars.

Estimate how many days it will take for your dollar to become over a million dollars.

Record your estimate: _____

Complete the chart below using your calculator.
(Note: on the calculator you are continually multiplying the number shown on the display by 2 without clearing the calculator.)

Day number	Number of magic dollars
1	1
2	2
3	4
4	8
5	16
6	32
7	64
8	128
9	256
10	512
11	1024
12	2048
13	4096
14	8192
15	16384
16	32768
17	65536
18	131072
19	262144
20	524288
21	1048576
22	
23	
24	

At what point were you surprised by the number of magic dollars?

_____

_____

How did the result differ from your expectations?

_____

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WATCH YOUR MONEY GROW
Student Activity Sheet 2
Teacher Answer Sheet

Somebody gives you a magic nickel. Each magic nickel grows overnight to three magic nickels. Estimate how many days it would take until your magic nickel becomes at least one million dollars.

Record your estimate: _____

Complete the chart below using your calculator. (Note: You continually multiply the number shown on the display by 3 without clearing the calculator or use your calculators constant function.)

Day number	Number of magic dollars
1	.05
2	.15
3	.45
4	1.35
5	4.05
6	12.15
7	36.45
8	109.35
9	328.05
10	984.15
11	2952.45
12	8857.35
13	26572.05
14	79716.15
15	239148.45
16	717445.35
17	2152336.05
18	
19	
20	

How did the result differ from your expectations?

Answer will vary.

Compare these results to those you found in Student Activity Sheet 1.

_____

_____

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WATCH YOUR MONEY GROW
Student Activity Sheet 3
Teacher Answer Sheet

Magic quarters double every night to 2 magic quarters. Magic pennies change every night to 4 magic pennies.

If you could borrow one of these coins for only 5 days, which coin would you choose?

Magic Quarter

If you could borrow one of these coins for 13 days, which would you choose?

Magic Penny

Now complete the chart. Use it to decide if you made the correct choices. Complete one column before starting the other.

Day number	Magic Quarter (multiply by 2)	Magic Penny (multiply by 4)
1	.25	.01
2	.50	.04
3	1	.16
4	2	.64
5	4	2.56
6	8	10.24
7	16	40.96
8	32	163.84
9	64	655.36
10	128	2621.44
11	256	10485.76
12	512	41943.04
13	1024	167772.16

What did you discover? Why do you think this happened?

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WATCH YOUR MONEY GROW
Teacher Answer Sheet

HOME ACTIVITY:

Discuss the following problem at home. If you were to sign a contract with your family that in return for keeping your room clean for an entire year you would to be given 1 penny the first day of February, two pennies the second day of February, 4 pennies the next, doubling each day until the month was over, would this be a fair deal? Would your family be willing to pay you that much?_____

Why or why not?_____

Using the calendar for February, fill in the amount of money that you would be paid each day.

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
	1 $.01	2 $.02	3 $.04	4 $.08	5 $.16	6 $.32
7 $.64	8 $1.28	9 $2.56	10 $5.12	11 $10.24	12 $20.48	13 $40.96
14 $81.92	15 $163.84	16 $327.68	17 $655.36	18 $1310.72	19 $2621.44	20 $5242.88
21 $10485.76	22 $20971.52	23 $41943.04	24 $83886.08	25 $167772.16	26 $335544.32	27 $671088.64
28 $1342177.28	(calculator	shows	1342177.2)			

What did you discover?_____

_____

_____

How did the results differ from your family's expectation?_____

_____

_____

_____

Share your discoveries from Student Activity Sheets 1, 2, and 3 with your family.

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Name _____

WATCH YOUR MONEY GROW
Student Activity Sheet 1

Somebody gives you a magic dollar. It is magic because every night it doubles so that the next day instead of one dollar you have two magic dollars.

Estimate how many days it will take for your dollar to become over a million dollars.

Record your estimate: _____

Complete the chart below using your calculator.
(Note: on the calculator you are continually multiplying the number shown on the display by 2 without clearing the calculator.)

Day number	Number of magic dollars
1	1
2	2
3	4
4	8
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	

At what point were you surprised by the number of magic dollars?

_____

_____

How did the result differ from your expectations?

_____

_____

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Name _____

WATCH YOUR MONEY GROW
Student Activity Sheet 2

Somebody gives you a magic nickel. Each magic nickel grows overnight to three magic nickels. Estimate how many days it would take until your magic nickel becomes at least one million dollars.

Record your estimate: _____

Complete the chart below using your calculator.(Note: You continually multiply the number shown on the display by 3 without clearing the calculator or use your calculators constant function.)

Day number	Number of magic dollars
1	.05
2	.15
3	.45
4	1.35
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

How did the result differ from your expectations?

_____

_____

Compare these results to those you found in Student Activity Sheet 1.

_____

_____

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Name _____

WATCH YOUR MONEY GROW
Student Activity Sheet 3

Magic quarters double every night to 2 magic quarters. Magic pennies change every night to 4 magic pennies.

If you could borrow one of these coins for only 5 days, which coin would you choose?

_____

If you could borrow one of these coins for 13 days, which would you choose?

_____

Now complete the chart. Use it to decide if you made the correct choices. Complete one column before starting the other.

Day number	Magic Quarter (multiply by 2)	Magic Penny (multiply by 4)
1	.25	.01
2	.50	.04
3		.16
4		.64
5		
6		
7		
8		
9		
10		
11		
12		
13		

What did you discover? Why do you think this happened?

_____

_____

_____

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Name_____

WATCH YOUR MONEY GROW

Home Activity Sheet

Discuss the following problem at home. If you were to sign a contract with your family that in return for keeping your room clean for an entire year you would to be given 1 penny the first day of February, two pennies the second day of February, 4 pennies the next, doubling each day until the month was over, would this be a fair deal? Would your family be willing to pay you that much?_____

Why or why not?_____

_____

Using the calendar for February, fill in the amount of money that you would be paid each day.

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
	1 $.01	2 $.02	3 $.04	4 $.08	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	(This is a non-Leap year February)					

What did you discover?

_____

_____

How did the results differ from your family's expectations?

_____

_____

Share your discoveries from Student Activity Sheets 1, 2, and 3 with your family.

CAMP-LA
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YOUR GAIN - YOUR LOSS

GRADE: 5 - 6

STRAND: Number

SKILL: Multiply or divide a number by a multi-digit number.

MANAGEMENT

CLASS ORGANIZATION: Individual or pairs

TIME FRAME: One or two math periods

MATERIALS: Calculator

VOCABULARY: Calories

PREREQUISITE SKILL: Multiply or divide decimals, round decimals

LESSON

- **DIRECTED INSTRUCTION/ GUIDED PRACTICE:**
  Note: Students relate mathematics to weight loss and gain.
  - Hand out Calorie Chart. Ask questions about doubling or tripling portions and its effect on the number of calories.
  - Hand out Student Activity Sheet 1. Do days 1-4 with the students and discuss the results. Students complete the chart.

- **INDEPENDENT PRACTICE:**
  - Hand out Student Activity Sheet 2. Students calculate the hours of each activity needed for Mad-Man to lose one pound.

    A class discussion should follow to determine which activities produce the quickest or slowest loss. Discuss that doctors are consulted for the most healthful weight loss program.

- **EVALUATION:**
  Teacher observation and Student Activity Sheets.

- **EXTENSION:**
  - Hand out Student Activity Sheet 3. Students complete the sheet independently. Answers will vary.

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YOUR GAIN - YOUR LOSS

Calorie Chart

Food	Measure	Calories
Apple	1 medium	80
Bacon (cooked)	1 slice	46
Banana	1 medium	81
Beef Stew	1 cup	218
Biscuits	4 oz	104
Blintz, Cheese	1	70
Bologna Sandwich	1	369
Cake, with icing	1 slice	274
Cantaloupe	1	70
Carrot	1	21
Cheerios	1 oz	112
Cheese, American	1 slice	113
Cheese Cake	1 slice	214
Chicken, Fried	1/2 chicken	437
Chocolate Milk Shake	11 oz serving	355
Chocolate Pudding	1/2 cup	174
Cookies, Chocolate Chip	1	58
Cookies, Oreo	1	50
Corned Beef Hash	4 oz serving	405
Doughnut	1	165
Egg, Hard Boiled	1	81
Enchilada	1	259
Frog Legs	4 oz serving	81
Fruit Cocktail	1/2 cup	89
Fudgsicle	1	102
Grapes	1 cup	104
Grapefruit	1	98
Hamburger (Fast Food)	1	251
Hot Dog with bun	1	255
Ice Cream	1 cup	272
Ice Cream Sandwich	1	173
Jellybeans	1 oz serving	104
Lasagna	8 oz serving	255
Lemon Pie	1 slice	227
Lettuce	1 head	59
Liver	4 oz serving	260
Lobster	4 oz serving	109
Macaroni and Cheese	1 cup	430
Muffin, Blueberry	1	115
Oatmeal	1 cup	150
Orange	1 medium	77
Pancake	1	84
Pizza (Cheese)	1 slice	184
Popcorn	1 cup	25
Potato Chips	1 oz	158
Spaghetti & Meat Balls	1 cup	322
Steak	1 lb	1596
Turkey	4 oz	253
Twinkies	1	144

From The Dictionary of Calories & Carbohydrates by Barbara Kraus

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YOUR GAIN - YOUR LOSS
Student Activity Sheet 1
Teacher Answer Sheet

Mad-Man David LeRoque the wrestler needs to gain weight.
His trainer has computed that Mad-Man must eat 4000 calories per day more than he usually eats. To get his additional 4000 calories, he decides to pick a different food for each of the 15 days in his weight gaining program. Help him plan his menu. Record your answers in the chart below.

Day 1: Mad-Man decides to eat his regular menu plus 4000 calories' worth of chocolate milkshakes. 1 milk shake has 355 calories.
To find how many milkshakes are needed, divide 4000 by 355 on your calculator. Record your answer. The calculator answer, 11.267605 is between 11 and 12. Eleven milkshakes will not provide the minimum 4000 calories, so he will drink twelve.

Use the calories chart provided to select additional foods to complete the chart.

Day	Food added to regular menu	Measure	Calories	Minimum Amount needed for 4000 calories
1	Chocolate Milk Shakes	11 oz serving	355	12 shakes
2	Steak	1 lb with bone	1596	3 steaks
3	Cheese Pizza	slice	184	22 slices
4	Popcorn (plain)	cup	25	160 cups
5	Apples	medium	80	50 medium
6	Carrots	1 carrot	21	191 carrots
7	Lettuce	1 head	59	68 heads
8	Answers will vary			
9				
10				
11				
12				
13				
14				
15				

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YOUR GAIN - YOUR LOSS
Student Activity Sheet 2
Teacher Answer Sheet

Mad-Man won his match and decided to lose weight. He weighed in at 300 pounds. His trainer needs to help him decide how much additional exercise he needs to do. Help Mad-Man's trainer plan his program by completing the chart below.
One pound of fat is equal to 3500 calories. Add this number of calories to those you need to balance your energy requirements and you will gain one pound; subtract it and you will lose a pound.

Calories for living			
A. Type of Activity	B. Approximate calories used per each pound of weight	C. Calories used per hour by a 300 pound man (column B x 300)	D. Hours of activity need to lose one pound (3500 ÷ column C round to the nearest tenth)
Sleeping	0.4	300 x 0.4 = 120	3500 ÷ 120 = 29.2
Sitting, studying, TV viewing	0.6	180	19.4
Writing	0.7	210	16.7
Eating	0.7	210	16.7
Sewing	0.7	210	16.7
Standing quietly	0.7	210	16.7
Dressing and undressing	0.9	270	13.0
Ironing clothes	1.0	300	11.7
Washing dishes	1.0	300	11.7
Typing	1.0	300	11.7
Washing clothes	1.1	330	10.6
Playing piano	1.2	360	9.7
Painting walls/furniture	1.3	390	9.0
Walking	1.5	450	7.8
Bicycle driving	1.7	510	6.9
Sweeping, vacuuming	1.9	570	6.1
Mowing lawn (power mower)	2.0	600	5.8
Skating	2.2	660	5.3
Horseback riding	2.6	780	4.5
Playing table tennis	2.7	810	4.3
Walking up hill	3.0	900	3.9
Running	4.0	1200	2.9
Active sports and games	4.5 or more	1350	2.6
Swimming	4.5	1350	2.6

- If Mad-Man wanted to lose 10 lbs, how would you suggest he do it? You may combine activities.

  Answer will vary

- Which activity from the chart produces the quickest weight loss? swimming

- Which produces the slowest weight loss? sleeping

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YOUR GAIN - YOUR LOSS

Student Activity Sheet 1

"Mad-Man" David LeRoque the wrestler needs to gain weight.
His trainer has computed that Mad-Man must eat 4000 calories per day more than he usually eats. To get his additional 4000 calories, he decides to pick a different food for each of the 15 days in his weight gaining program. Help him plan his menu. Record your answers in the chart below.

Day 1: Mad-Man decides to eat his regular menu plus 4000 calories' worth of chocolate milkshakes. 1 milkshake has 355 calories.
To find how many milkshakes are needed, divide 4000 by 355 on your calculator. Record your answer. The calculator answer, 11.267605 is between 11 and 12. Eleven milkshakes will not provide the minimum 4000 calories, so he will drink twelve.

Use the calories chart provided to select additional foods to complete the chart.

Day	Food added to regular menu	Measure	Calories	Minimum Amount needed for 4000 calories
1	Chocolate Milk Shakes	11 oz serving	355	12 shakes
2	Steak	1 lb with bone	1596	
3	Cheese Pizza	slice	184	
4	Popcorn (plain)	cup	25	
5	Apples	medium		
6	Carrots			
7	Lettuce			
8				
9				
10				
11				
12				
13				
14				
15				

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YOUR GAIN - YOUR LOSS
Student Activity Sheet 2

Mad-Man won his match and decided to lose weight. He weighed in at 300 pounds. His trainer needs to help him decide how much additional exercise he needs to do. Help Mad-Man's trainer plan his program by completing the chart below.
One pound of fat is equal to 3500 calories. Add this number of calories to those you need to balance your energy requirements and you will gain one pound; subtract it and you will lose a pound.

Calories for living			
A. Type of Activity	B. Approximate calories used per each pound of weight	C. Calories used per hour by a 300 pound man (column B x 300)	D. Hours of activity needed to lose one pound (3500 ÷ column C rounded to the nearest tenth)
Sleeping	0.4	300 x 0.4 = 120	3500 ÷ 120 = 29.6
Sitting, studying, TV viewing	0.6		
Writing	0.7		
Eating	0.7		
Sewing	0.7		
Standing quietly	0.7		
Dressing and undressing	0.9		
Ironing clothes	1.0		
Washing dishes	1.0		
Typing	1.0		
Washing clothes	1.1		
Playing piano	1.2		
Painting walls/furniture	1.3		
Walking	1.5		
Bicycle driving	1.7		
Sweeping, vacuuming	1.9		
Mowing lawn (power mower)	2.0		
Skating	2.2		
Horseback riding	2.6		
Playing table tennis	2.7		
Walking up hill	3.0		
Running	4.0		
Active sports and games	4.5 or more		
Swimming	4.5		

- If Mad-Man wanted to lose 10 lbs, how would you suggest he do it? You may combine activities.

_____

- Which activity from the chart produces the quickest weight loss? _____
- Which produces the slowest weight loss? _____

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YOUR GAIN - YOUR LOSS
Student Activity Sheet 3

Plan additional activities for Mad-Man David LeRoque for 1 week. Be sure to vary his activities daily.

Complete the chart. (use your results from Student Activity Sheet 2)

BE REALISTIC

Day	Activities	Hours	Pounds Lost
Sunday			
Monday			
Tuesday			
Wednesday			
Thursday			
Friday			
Saturday			

At this rate, how many weeks will it take Mad-Man to lose 25 pounds? _____

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DECIMAL DISCOVERY

GRADE: 5 - 6

STRAND: Number

SKILL(S): Change fractions and mixed numbers to decimal form or vice versa. Identify equivalent fractions.

MANAGEMENT

CLASS ORGANIZATION: Pairs of students or small groups

TIME FRAME: One math period

MATERIALS: Calculator

VOCABULARY: Equivalent, fractions, numerator, denominator

PREQUISITE SKILL: Understand fractions

LESSON

DIRECTED INSTRUCTION/GUIDED PRACTICE:

We are going to change fractions to decimals and use our results to make discoveries about numbers.

To change a fraction to its decimal name, divide the numerator by the denominator.

Practice with a few examples: $\frac{3}{8} \rightarrow 3 \div 8 = 0.375$.

- **INDEPENDENT PRACTICE:**

Students complete Student Activity Sheets 1 and 2. Discuss all results. Discuss the fact that equivalent fractions have identical decimal representations. Use problems on the Student Activity Sheet as examples. Ask the class the following questions.

1) Why do some of the decimal answers fill the display?

2) Do some of the decimal answers have repeating digits?

3) Can you tell by the numerator or denominator which fractions will fill the display?

4) What is the relationship between the decimal representation of a fraction and its multiples? For example: if $\frac{1}{5} = .2$, how can you find $\frac{2}{5}$, $\frac{3}{5}$, $\frac{4}{5}$, without dividing?

5) What do you notice about the decimal representations of equivalent fractions?

- **EVALUATION:**

Teacher Observation

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DECIMAL DISCOVERY
Converting Fractions to Decimals
Teacher Answer Sheet 1

Fraction	Calculator Display	Fraction	Calculator Display	Fraction	Calculator Display
a. $\frac{1}{2}$	0.5	b. $\frac{7}{77}$	0.090909	c. $\frac{7}{14}$	0.5
d. $\frac{9}{99}$	0.090909	e. $\frac{5}{40}$	0.125	f. $\frac{1}{11}$	0.090909
g. $\frac{9}{27}$	0.3333333	h. $\frac{14}{28}$	0.5	i. $\frac{1}{8}$	0.125
j. $\frac{3}{33}$	0.090909	k. $\frac{6}{12}$	0.5	l. $\frac{11}{88}$	0.125
m. $\frac{11}{22}$	0.5	n. $\frac{8}{64}$	0.125	o. $\frac{4}{12}$	0.3333333
p. $\frac{2}{16}$	0.125	q. $\frac{11}{33}$	0.3333333	r. $\frac{1}{3}$	0.3333333

Answer these questions using your answers from the previous page.

1) a. Which fractions have 0.125 for an answer?
$\frac{1}{8}$, $\frac{5}{40}$, $\frac{8}{64}$, $\frac{2}{16}$, $\frac{11}{88}$

b. Write what you notice about the fractions that have 0.125 for an answer.
They are all equivalent to $\frac{1}{8}$

c. List three other fractions that have 0.125 as their decimal representation.
$\frac{7}{56}$, $\frac{3}{24}$, $\frac{4}{32}$, etc.

2) a. Which fractions have 0.5 for an answer?
$\frac{1}{2}$, $\frac{7}{14}$, $\frac{6}{12}$, $\frac{11}{22}$, $\frac{14}{28}$

b. Write what you notice about the fractions that have 0.5 for an answer.
They are all equivalent to $\frac{1}{2}$.

c. List three other fractions that have an answer of 0.5.
$\frac{2}{4}$, $\frac{3}{6}$, $\frac{4}{8}$, etc.

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3) a. Which fractions have 0.3333333 on your calculator display?

$\frac{1}{3}$, $\frac{9}{27}$, $\frac{3}{33}$, $\frac{11}{33}$, $\frac{4}{12}$

b. What do you notice about the fractions that show 0.3333333 on the calculator?

They are all equivalent to $\frac{1}{3}$

c. List three more fractions that change to 0.3333333.

$\frac{2}{6}$, $\frac{3}{9}$, $\frac{5}{15}$, etc.

4) a. Which fractions show 0.090909 on your calculator display?

$\frac{1}{11}$, $\frac{9}{99}$, $\frac{7}{77}$, $\frac{3}{33}$

b. What do you notice about these fractions?

They are all equivalent to $\frac{1}{11}$

c. Find three more fractions that have this answer.

$\frac{2}{22}$, $\frac{4}{44}$, $\frac{5}{55}$, etc.

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DECIMAL DISCOVERY
Student Activity Sheet 2
Teacher Answer Sheet

Complete the activity sheet by converting fractions to decimals (use your calculator when necessary).

1 $\frac{1}{5} = 0.2$ 2 $\frac{2}{5} = 0.4$ 3 $\frac{3}{5} = 0.6$ 4 $\frac{4}{5} = 0.8$

5 $\frac{5}{5} = 1$ 6 $\frac{6}{5} = 1.2$ 7 $\frac{7}{5} = 1.4$ 8 $\frac{8}{5} = 1.6$

What do you notice about your answers?

Predict the calculator display for these problems. Check with your calculator.

1 $\frac{1}{3}$ 0.3333333 2 $\frac{2}{3}$ 0.6666666 3 $\frac{3}{3} = 1$

What will you predict for $\frac{3}{3}$ using patterns? 0.9999999

What is your calculator answer for $\frac{3}{3}$? 1

Why do you think this occurs? 0.9999999 ... is equivalent to 1

	Calculator Display		Calculator Display		Calculator Display
1 $\frac{1}{9}$	0.1111111	2 $\frac{2}{9}$	0.2222222	3 $\frac{3}{9}$	0.3333333
4 $\frac{4}{9}$	0.4444444	5 $\frac{5}{9}$	0.5555555	6 $\frac{6}{9}$	0.6666666
7 $\frac{7}{9}$	0.7777777	8 $\frac{8}{9}$	0.8888888	9 $\frac{9}{9}$	1

What do you notice about your answers?

The numerator is the repeated number in the decimal pattern of ninths. Note: 0.9999999 ... is equivalent to 1.

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DECIMAL DISCOVERY
Converting Fractions to Decimals
Student Activity Sheet 1

Fraction	Calculator Display	Fraction	Calculator Display	Fraction	Calculator Display
a. $\frac{1}{2}$		b. $\frac{7}{77}$		c. $\frac{7}{14}$	
d. $\frac{9}{99}$		e. $\frac{5}{40}$		f. $\frac{1}{11}$	
g. $\frac{9}{27}$		h. $\frac{14}{28}$		i. $\frac{1}{8}$	
j. $\frac{3}{33}$		k. $\frac{6}{12}$		l. $\frac{11}{88}$	
m. $\frac{11}{22}$		n. $\frac{8}{64}$		o. $\frac{4}{12}$	
p. $\frac{2}{16}$		q. $\frac{11}{33}$		r. $\frac{1}{3}$	

Answer these questions using your answers from the previous page.

1) a. Which fractions have 0.125 for an answer?

_____

b. Write what you notice about the fractions that have 0.125 for an answer.

_____

c. List three other fractions that have 0.125 as their decimal representation.

_____

2) a. Which fractions have 0.5 for an answer?

_____

b. Write what you notice about the fractions that have 0.5 for an answer.

_____

c. List three other fractions that have an answer of 0.5.

_____

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DECIMAL DISCOVERY:
Student Activity Sheet 1 (cont.)

3) a. Which fractions have 0.3333333 on your calculator display?

_____

b. What do you notice about the fractions that show 0.3333333 on the calculator?

_____

_____

c. List three more fractions that change to 0.3333333.

_____

4) a. Which fractions show 0.0909090 on your calculator display?

_____

b. What do you notice about these fractions?

_____

_____

c. Find three more fractions that have this answer.

_____ _____ _____

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DECIMAL DISCOVERY
Student Activity Sheet 2

Complete the activity sheet by converting fractions to decimals (use your calculator when necessary).

1 $\frac{1}{5}$ _____ 2 $\frac{2}{5}$ _____ 3 $\frac{3}{5}$ _____ 4 $\frac{4}{5}$ _____

5 $\frac{5}{5}$ _____ 6 $\frac{6}{5}$ _____ 7 $\frac{7}{5}$ _____ 8 $\frac{8}{5}$ _____

What do you notice about your answers?

Predict the calculator display for these problems. Check with your calculator.

1 $\frac{1}{3}$ _____ 2 $\frac{2}{3}$ _____ 3 $\frac{3}{3}$ _____

What will you predict for $\frac{3}{3}$ using patterns? _____

What is your calculator answer for $\frac{3}{3}$? _____

Why do you think this occurs? _____

	Calculator Display		Calculator Display		Calculator Display
1 $\frac{1}{9}$	_____	2 $\frac{2}{9}$	_____	3 $\frac{3}{9}$	_____
4 $\frac{4}{9}$	_____	5 $\frac{5}{9}$	_____	6 $\frac{6}{9}$	_____
7 $\frac{7}{9}$	_____	8 $\frac{8}{9}$	_____	9 $\frac{9}{9}$	_____

What do you notice about your answers?

_____

_____

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MYSTERY SPACES

GRADE: 5 - 6

STRAND: Algebra/Number

SKILL: Find the missing symbol or digit.

MANAGEMENT

CLASS ORGANIZATION: Individual or pairs

TIME FRAME: One math period

MATERIALS: Calculator

VOCABULARY: Digit, symbol, equation

PREREQUISITE SKILL: Estimation strategies, number sense

LESSON

- **DIRECTED INSTRUCTION/GUIDED PRACTICE:**

  All equations on the Student Activity Sheets have either one digit or one symbol missing. Students will use their estimation strategies and context clues to find the missing digit or symbol. They check their answers mentally or with the calculator. They continue the process until they find the correct answer. For each of the following equations, ask, "Which is missing a symbol or a digit? Why? What should be in the space?"

  A. 2[ ]5 + 2 = 237 A digit is missing. There should be a 3 because 235 + 2 = 237.

  B. 2 [ ] 5 + 2 = 9 A symbol is missing. There should be a + sign because 2 + 5 + 2 = 9.

  C. .2 + [ ] 3 = .5 A symbol is missing. There should be a decimal point because .2 + .3 = .5

- **INDEPENDENT PRACTICE:**

  Pass out Student Activity Sheet 1 and/or Student Activity Sheet 2. Use one or both worksheets depending on the level and experience of your class.

  Student Activity Sheet 1 involves working only with whole numbers.

  Student Activity Sheet 2 involves working with whole numbers and decimals.

- **EVALUATION:**

  Teacher observation and Student Activity Sheets.

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MYSTERY SPACES
Student Activity Sheet 1
Teacher Answer Sheet

Determine the missing digit or symbol. Complete the equation. Check your answers using your calculator.

Digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
Symbols +, -, x, ÷, =, . (decimal point)

	Fill in the blanks.	Is there a missing digit or missing symbol?
1.	159 + 387 = 5[4]6	(Digit)
2.	800 - 25[6] = 544	(Digit)
3.	96 [-] 35 - 21 = 40	(Symbol)
4.	23 x 56 [=] 1288	(Symbol)
5.	878 + [9]35 = 1813	(Digit)
6.	5555 x 666[6] = 37,029,630	(Digit)
7.	6258 - [3]897 = 2361	(Digit)
8.	2764 [+] 9765 = 12,529	(Symbol)
9.	147 x [2]58 = 37,926	(Digit)
10.	8[6] + 2 = 43	(Digit)
11.	11,111 - 2222 = 88[8]9	(Digit)
12.	3 x 5 [+] 20 = 35	(Symbol)
13.	5530 ÷ 158 = 3[5]	(Digit)
14.	12345[6] - 98765 = 24,691	(Digit)
15.	82 [+] 47 + 65 = 194	(Symbol)
16.	36 [÷] 6 + 2 = 8	(Symbol)
17.	3 [x] 4 + 2 = 14	(Symbol)
18.	0 [x] 7 = 0 or 0 [÷] 7 = 0	(Symbol)
19.	359 + [3]43 = 702	(Digit)
20.	1,000 - 73[6] = 264	(Digit)

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MYSTERY SPACES
Student Activity Sheet 2
Teacher Answer Sheet

Determine the missing digit or symbol. Complete the equation. Check your answers using your calculator.

Digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
Symbols +, -, x, ÷, =, . (decimal point)

	Fill in the blanks.	Is there a missing digit or missing symbol?
1.	2.73 + [4] = 6.73	(Digit)
2.	.8 x .3 = [.] 24	(Symbol)
3.	842 - .9 = 841.[1]	(Digit)
4.	4 [+] .2 = 20	(Symbol)
5.	[3]60 + 210.43 = 570.43	(Digit)
6.	.1 [+] .02 = .12	(Symbol)
7.	.1 [-] .02 = .08	(Symbol)
8.	.1 [+] .02 = 5	(Symbol)
9.	.1 [x] .02 = .002	(Symbol)
10.	.9 - .2 [+] .2 = .9	(Symbol)
11.	.7 + .2 + .[1] = 1	(Digit)
12.	20 x [.09] = 1.8	(Digit)
13.	35 ÷ .[5] = 70	(Digit)
14.	854.32 + 372.8 [=] 1227.12	(Symbol)
15.	.3 x .2 +.9[4] = 1.00	(Digit)

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MYSTERY SPACES
Student Activity Sheet 1

Determine the missing digit or symbol. Complete the equation. Check your answers using your calculator.

Digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
Symbols +, -, x, ÷, =, . (decimal point)

	Fill in the blanks.	Is there a missing digit or missing symbol?
1.	159 + 387 = 5[ ]6	
2.	800 - 25[ ] = 544	
3.	96 [ ] 35 - 21 = 40	
4.	23 x 56 [ ] 1288	
5.	878 + [ ]35 = 1813	
6.	5555 x 666[ ] = 37,029,630	
7.	6258 - [ ]897 = 2361	
8.	2764 [ ] 9765 = 12,529	
9.	147 x [ ]58 = 37,926	
10.	8[ ] ÷ 2 = 43	
11.	11,111 - 2222 = 88[ ]9	
12.	3 x 5 [ ] 20 = 35	
13.	5530 ÷ 158 = 3[ ]	
14.	12345[ ] - 98765 = 24,691	
15.	82 [ ] 47 ÷ 65 = 194	
16.	36 [ ] 6 ÷ 2 = 8	
17.	3 [ ] 4 ÷ 2 = 14	
18.	0 [ ] 7 = 0	
19.	359 + [ ]43 702	
20.	1,000 - 73[ ] = 264	

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MYSTERY SPACES
Student Activity Sheet 2

Determine the missing digit or symbol. Complete the equation. Check your answers using your calculator.

Digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
Symbols +, -, x, ÷, =, . (decimal point)

	Fill in the blanks.	Is there a missing digit or missing symbol?
1.	2.73 + [ ] = 6.73	
2.	.8 x .3 = [ ] 24	
3.	842 - .9 = 841.[ ]	
4.	4 [ ] .2 = 20	
5.	[ ]60 + 210.43 = 570.43	
6.	.1 [ ] .02 = .12	
7.	.1 [ ] .02 = .08	
8.	.1 [ ] .02 = 5	
9.	.1 [ ] .02 = .002	
10.	.9 - .2 [ ] .2 = .9	
11.	.7 + .2 + .[ ] = 1	
12.	20 x [ ] = 1.8	
13.	35 ÷ .[ ] = 70	
14.	854.32 + 372.8 [ ] 1227.12	
15.	.3 x .2 +.9[ ] = 1.00	

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PARDON MY DEAR AUNT SALLY

GRADE: 5 - 6

STRAND: Algebra

SKILL: Use order of operations to compute.

MANAGEMENT

CLASS ORGANIZATION: Partner/Individual

TIME FRAME: One or two math periods

MATERIALS: Calculator

VOCABULARY: Order of operations, experiments

PREREQUISITE SKILL: Basic operations, exponents

LESSON

- **DIRECTED INSTRUCTION:**
  - Teacher asks: "John put on his shoes, his socks and his pants. If this were the order in which he dressed, would it make sense? If not, why? What would be better?"

    "Now, use your calculator to solve 6 + 15 x 5 = ☐"
  - Teacher asks: "What answer did you get? Did anyone get another answer? How did you get your answers?"
  - Place the two possible responses on the board:

6 + 15 x 5 =	☐	6 + 15 x 5 =	☐
21 x 5 =	☐	6 + 75 =	☐
105 =	☐	81 =	☐

  - Explain that mathematicians have developed rules to avoid getting two answers for this kind of problem. (Note: the "Rules for Order of Operations" page may be used as a transparency for the overhead projector.)

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- **GUIDED PRACTICE:**
  - Hand out Student Activity Sheet 1 and Rules For The Order Of Operations.

    Part 1 Directions: Underline the pair of numbers and the operation you will do first and then complete the problem.

    1. 8 + 9 x 7 = **71**
    2. 135 - 7 x 9 =**72**
    3. 29 + 58 x 32 =**1885**
    4. 3 x 15 - 11 = **34**
    5. 58 + 2 + 63 = **92**
    6. 516 + 6 + 742 = **828**

    Discuss and verify correct responses.

- **INDEPENDENT PRACTICE:**
  Students complete Activity Sheet 1, Part 2.

  Part 2 Directions: Use the Order of Operations to solve:

  1. (5 x 3) + (9 x 6) + 10 = **79**
  2. 5 x (3 x 9) x (6 + 10) = **2160**
  3. (5 x 3) + 9 x (6 + 10) = **159**
  4. 12 x 15 + 17 x 19 = **503**
  5. 12 x 15 - 17 x 6 = **78**
  6. 12 + 3 + 72 + 9 = **12**
  7. 115 + 5 - (18 - 12) = **17**
  8. 42 + 37 + 15 - 2 x 3 = **88**
  9. 42 + 37 + (15 - 2) x 3 = **118**
  10. 42 + 30 + 15 x 3 = **48**

- **EVALUATION:**
  Teacher observation and Student Activity Sheets.

- **EXTENSION ACTIVITY**
  Students complete Student Activity Sheet 2.

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PARDON MY DEAR AUNT SALLY

Transparency
RULES FOR THE ORDER OF OPERATIONS

1) **PARENTHESES**	[Do all operations x, ÷, + -, **INSIDE** parentheses ( ) first.]
2) **MULTIPLY & DIVIDE**	[Multiply and divide in order. If division appears to the left of multiplication, then divide before multiplying.]
3) **ADD & SUBTRACT**	[Add and subtract in order, left to right]

The acceptable answer to
6 + 15 x 5 would be the same as
6 + (15 x 5)=
or **6 + 75 = 81**

Memory device for this rule:

Pardon	My	Dear	Aunt	Sally
a	u	i	d	u
r	l	v	d	b
e	t	i		t
n	i	d		r
t	p	e		a
h	l			c
e	ty			t
s				
e				
s				

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PARDON MY DEAR AUNT SALLY

RULES FOR THE ORDER OF OPERATIONS

1) PARENTHESES	[Do all operations x, +, +, -, and powers **INSIDE** of parentheses ( ) first.]
2) MULTIPLY & DIVIDE	[Multipy and divide in order. If division appears to the left of multiplication, then divide before multiplying.]
3) ADD & SUBTRACT	[Add and subtract in order, left to right.]

The accepted answer to

6 + 15 x 5 would be the same as
6 + (15 x 5) =
6 + 75 = 81

Memory device for this rule:

Pardon	My	Dear	Aunt	Sally
a	u	i	d	u
r	l	v	d	b
e	t	i		t
n	i	d		r
t	p	e		a
h	l			c
e	ty			t
s				
e				
s				

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PARDON MY DEAR AUNT SALLY

Student Activity Sheet 1

Part 1 Directions: Underline the pair of numbers and operation you will do first and then complete the problem.

1. 8 + 9 x 7 = _____

2. 15 - 7 x 9 = _____

3. 29 + 58 x 32 = _____

4. 3 x 15 - 11 = _____

5. 58 + 2 + 63 = _____

6. 516 + 6 + 742 = _____

Part 2 Directions: Use the Order of Operations to compute.

1. (5 x 3) + (9 x 6) + 10 = _____

2. 5 x (3 x 9) x (6 + 10) = _____

3. (5 x 3) + 9 x (6 + 10)= _____

4. 12 x 15 + 17 x 19 = _____

5. 12 x 15 - 17 x 6 = _____

6. 12 + 3 + 72 + 9 = _____

7. 115 + 5 - (18 - 12) = _____

8. 42 + 37 + 15 - 2 x 3 = _____

9. 42 + 37 + (15 - 2) x 3 = _____

10. 42 + 30 + 15 x 3 = _____

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Name_____

PARDON MY DEAR AUNT SALLY
Student Activity Sheet 2

RULES FOR ORDER OF OPERATIONS WITH EXPONENTS

1) PARENTHESES	[Do all operations x, ÷, +, -, and powers **INSIDE** of parentheses ( ) first.]
2) EXPONENTS	[Find value of any powers (exponents)]
3) MULTIPLY & DIVIDE	[Multipy and divide in order. If division appears to the left of multiplication, then divide before multiplying.]
4) ADD & SUBTRACT	[Add and subtract in order, left to right.]

Memory device for this rule:

( )	n^2	X	÷	+	−
Please	Excuse	My	Dear	Aunt	Sally
a	x	u	i	d	u
r	p	l	v	d	b
e	o	t	i		t
n	n	i	d		r
t	e	p	e		a
h	n	l			c
e	t	y			t
s	s				
e					
s					

Rewrite the exponents: $2^3 = 2 \times 2 \times 2$

Example: $4 + 2^3$ is the same as $4 + 8 = 12$

$(2 + 4)^3$ is the same as $6^3 = 216$

1. $7 + 3^2 = 16$
2. $(7 + 3)^2 = 100$
3. $7^2 + 3 = 52$
4. $49^2 + 35 = 2436$
5. $(5 + 3) + 9 \times 6 + 10^2 = 162$
6. $(49 + 35)^2 = 7056$

Write and solve 5 new problems on the back of this page.

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MULTIPLE MADNESS

GRADE: 5 - 6

STRAND: Number

SKILL: Find least common multiples

MANAGEMENT

CLASS ORGANIZATION: Pairs

TIME FRAME: One or two math periods

MATERIALS: Calculator

VOCABULARY: Multiples, least common multiple, common multiples

PREREQUISITE SKILL: Multiples and least common multiple

LESSON

- **DIRECTED INSTRUCTION:**
  Review with students the use of the constant function to find multiples of a number. e.g. [on/c] [+] [3] [=] [=] [=] or 0 + 3 [=] [=] [=] ... displays the multiples of 3.

- **GUIDED PRACTICE:**
  Divide the class into pairs, A's and B's. The A's number is 250, and the B's number is 175.

1. Student A enters [0] [+] [250] [=] on his calculator.

2. Student B enters [0] [+] [175] [=] on her calculator.
   Student A now has 250 on the calculator display. Student B has 175.

3. **The student with the smaller number in the calculator display presses the equal sign.**

4. Repeat step 3 until the numbers in the displays of both students' calculators match. (When Student A passes Student B, student B presses [=] until matching or passing Student A, etc.)

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Calculator display

Student A Calculator	Student B Calculator
*175	250
350	*250
*350	500
525	*500
*525	750
*700	750
875	*750
*875	1000
1050	*1000
*1050	1250
*1225	1250
1400	*1250
*1400	1500
1575	*1500
*1575	1750
1750	1750

* Indicates which Student presses the [=] sign next

Explain that since Student A was finding multiples of 175 and Student B was finding multiples of 250, the Least Common Multiple of 175 and 250 must be 1750.

- **INDEPENDENT PRACTICE:**
  Hand out Student Activity Sheet. Students work in pairs to complete the worksheet.
  Discuss the fact that since you are finding the multiples of the two numbers, when they match you have found the Least Common Multiple (LCM). The number of times each student hits the = sign (including original entry) indicates what the original number must be multiplied by to find the Least Common Multiple.

- **EVALUATION:**
  Responses to questions about Least Common Multiple

- **HOME ACTIVITY:**
  Write a word problem that can be solved by finding the Least Common Multiple (LCM) of two numbers.

  (Example: Machine A prints a poster every 18 minutes, Machine B every 24 minutes. How long will it be when they print their first poster simultaneously? Answer: Least Common Multiple of 18 and 24 = 72 minutes.)

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MULTIPLE MADNESS
Student Activity Sheet
Teacher Answer Sheet

Directions:
A. First student enters [0] [+] [First Number] [=] on a calculator.
B. Second student enters [0] [+] [Second Number] [=] on second calculator.
C. Student with the smaller number in the calculator display, presses [=]
D. Repeat step C until the numbers in the display of both calculators match.
E. When the numbers in the display of both calculators first match, you have identified the Least Common Multiple.

1.

First Number	Second Number	Least Common Multiple
35	77	**385**
210	54	**1890**
25	200	**200**
143	55	**715**
217	155	**1085**

2. Can you tell by looking at the numbers which person will need to press [=] more times? Explain.

The person with the lower number will always press [=] more times.

Using the first example: note that it takes 11 (35's) but only 5 (77's) to equal 385. The 11 and the 5 are the # of times [=] had to be pressed.

3. How could you find the Least Common Multiple of 3 numbers using calculators? You can use 3 calculators and follow a similar process as above. Again, the student with the smallest number in the display presses [=]. Eventually all three calculators will be displaying the same number. That number is the Least Common Multiple for the original 3 numbers.

4. Experiment to find 2 numbers between 50 and 60 whose Least Common Multiple is found when you and your partner alternately press [=] (No person presses [=] twice in a row while still following rule C)
Answer will vary. Two numbers 51 & 52. Their L.C.M. is 2652

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5. a) Use 11 and 13 for your starting numbers. Use tally marks. Count how many times each of you pressed the [=] (Including the original 0 + 11 [=] or 0 [+] 13 [=])

What does this number represent?

It indicates what your original number must be multiplied by to get the L.C.M.

b) Divide the Least Common Multiple by the number of times you pressed the equal sign. What does this number represent?

It's your original number.

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Name _____

MULTIPLE MADNESS
Student Activity Sheet

Directions:
A. First student enters [0] [+] [First Number] [=] on a calculator.
B. Second student enters [0] [+] [Second Number] [=] on second calculator.
C. Student with the smaller number in the calculator display, presses [=]
D. Repeat step C until the numbers in the display of both calculators match.
E. When the numbers in the display of both calculators first match, you have identified the Least Common Multiple.

1.

First Number	Second Number	Least Common Multiple
35	77	
210	54	
25	200	
143	55	
217	155	

2. Can you tell by looking at the numbers which person will need to press [=] more times? Explain.

_____

_____

3. How could you find the Least Common Multiple of 3 numbers using calculators? _____

_____

_____

4. Experiment to find 2 numbers between 50 and 60 whose Least Common Multiple is found when you and your partner alternately press [=] (No person presses [=] twice in a row while still following rule C)

_____

5. a. Use 11 and 13 for your starting numbers. Use tally marks. Count how many times each of you pressed [=] (Including the original 0 + 11 = or 0 + 13 =) What does this number represent? _____

b. Divide the Least Common Multiple by the number of times you pressed the [=] sign. What does this number represent? _____

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DUBIOUS DISCOUNTS

GRADE: 5 - 6

STRAND: Number

SKILL: Apply knowledge of percent to a consumer application.

MANAGEMENT

CLASS ORGANIZATION: Pairs

TIME FRAME: One math period

MATERIALS: Calculator

VOCABULARY: Percent, discount

PREREQUISITE SKILL: Round decimals to nearest whole number

LESSON

- **DIRECTED INSTRUCTION:**
  1. Work through this example with the class. Find the percent of discount if an $80.00 Graphite Tennis Racket is on sale for $39.89. (Round your answer to the nearest percent)

  First find the discount. Discount indicates the amount of money saved.

  Original Price - Sale Price = Discount
  $80.00 - $39.89 = $40.11

  Next, find the percent of discount. Percent of discount is the percent of money saved.

  Discount ÷ Original Price = Percent of Discount

  $40.11 ÷ $80.00 = .501375 ≈ .50 = 50%

- **GUIDED PRACTICE:**
  1. Hand out Student Activity Sheet.
  2. Students do the first 2 problems with their partners. Discuss results with the class.

- **INDEPENDENT PRACTICE:**
  Students complete Student Activity Sheet.

- **EVALUATION:**
  Teacher observation and Student Activity Sheet.

- **EXTENSION:**
  Choose sale items in newspaper ads to find the percent of discount. Be sure the items show the original cost.

CAMP-LA
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Name_____

DUBIOUS DISCOUNTS
Student Activity Sheet
Teacher Answer Sheet

1. What percent would you save if a $50.00 portable telephone is on sale for $29.90?

   Original price $50.00 - Sales Price $29.90 = Discount $20.10

   Discount $20.10 ÷ Original Price $50.00 = .402 ≈ .40 (round to the nearest hundredth)

   = 40 % discount

2. A "Pitchback" game is on sale for $11.87. The original price was $15.00.
   What is the discount? $3.13
   What is the percent of discount? .2086666 ≈ .21 = 21 %

   Use your calculator to find the discount and the percent of discount for the items in the chart.

Sport Mart

Item	Original Price	Sales Price	Discount	Percent of Discount (Round to the nearest percent)
Magic Johnson Basketball	$14.00	$11.00	$3.00	21%
Sportscraft Soccerball	$12.00	$9.00	$3.00	25%
Timex Watch	$24.95	$17.00	$7.95	32%
Macgregor Softball Glove	$30.00	$21.85	$8.15	27%
Eagle Graphite Hooksetter Rod	$75.00	$49.90	$25.10	33%
10-Speed, 22" bicycle	$85.00	$59.99	$25.01	29%
Sleeping bag - "Synthesis 1"	$80.00	$58.90	$21.10	26%
Hydroglide Swim Fins	$15.00	$12.25	$2.75	18%
NASA Carbonflex Swim Fins	$50.00	$39.90	$10.10	20%
Aquacraft Silicone Dive Mask	$40.00	$29.92	$10.08	25%

Which item showed the smallest percent of discount? Hydroglide Swim Fins 18%

Which item showed the greatest percent of discount? Hooksetter Rod 33%

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Name_____

DUBIOUS DISCOUNTS
Student Activity Sheet

1. What percent would you save if a $50.00 portable telephone is on sale for $29.90?

   Original price _____ - Sales Price _____ = Discount _____

   Discount ____ ÷ Original Price _____ = .____ =_____(round to nearest hundredth)

   = _____ % of discount

2. A "Pitchback" game is on sale for $11.87. The original price was $15.00.
   What is the discount? _____
   What is the percent of discount? _____

Use your calculator to find the discount and the percent of discount for the items in the chart.

Sport Mart

Item	Original Price	Sales Price	Discount	Percent of Discount (Round to the nearest percent)
Magic Johnson Basketball	$14.00	$11.00	$3.00	21%
Sportscraft Soccerball	$12.00	$9.00		
Timex Watch	$24.95	$17.00		
Macgregor Softball Glove	$30.00	$21.85		
Eagle Graphite Hooksetter Rod	$75.00	$49.90		
10-Speed, 22" bicycle	$85.00	$59.99		
Sleeping bag - "Synthesis 1"	$80.00	$58.90		
Hydroglide Swim Fins	$15.00	$12.25		
NASA Carbonflex Swim Fins	$50.00	$39.90		
Aquacraft Silicone Dive Mask	$40.00	$29.92		

Which item showed the smallest percent of discount? _____

Which item showed the greatest percent of discount? _____

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GOING CAMPING

GRADE: 5 - 6

STRAND: Number

SKILL: Solve real life problems.

MANAGEMENT

CLASS ORGANIZATION: Small groups

TIME FRAME: Two math periods

MATERIALS: Calculator, Data Organization Sheet, Guess and Check Sheet

VOCABULARY: Profit

PREREQUISITE SKILL: Interpret decimal remainders

LESSON

- **DIRECTED INSTRUCTION:**

  Tell each group they will be given a situation to solve in which they will be responsible for:

  Organizing their data
  Deciding what information is important
  Determining a solution
  Sharing with the class

- **GUIDED AND INDEPENDENT PRACTICE:**

  1st Day of lesson
  - Hand out Student Activity Sheet 1 and Data Organization Sheet.
  - Students read the problem and work together to complete the Data Organization Sheet and then Student Activity Sheet 1.
  - Students compare how they arrived at their answers. Make sure discussion focuses on how to deal with remainders in real life situations.

  2nd Day of Lesson
  - Hand out Student Activity Sheet 2 and Guess and Check Sheet. Have student complete both. Discuss results. Answers will vary.

- **EVALUATION:**

  Teacher observation and Student Activity Sheets.

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GOING CAMPING
Student Activity Sheet 1
Teacher Answer Sheet

Situation:

The students in room 18 want to go on a class camping trip. There are 32 students in the class. Food will cost $2.25 per meal for each person. Students will bring their own clothes and a sleeping bag. The camping equipment will be borrowed from the students' families. School vans will be used to get to the campsite. The van holds 12 people and gets 15 miles per gallon. The school district will provide vans for free that normally rent for $60.00 per day. The campsite is 76 miles from the school. Gasoline costs $.93 a gallon.

Campsites cost $12.00 per night and each campsite will hold 8 people. The principal says there should be 1 adult for every 6 students. The camping trip will last from 5:00 p.m. Friday night to 4:00 p.m. Sunday afternoon.

The students must raise the money for gas, food, and the campsites for everyone involved.

How much money must be raised for each student to go on the camping trip? What is the total cost? Use the Data Organization Sheet to complete information below.

Total cost for food.	$513 [(32 students ÷ 6 adults) x (6 meals @ 2.25/meal = Total]
Total cost for vans.	$37.70 [38 people ÷ 12 people/van = 3.2 need 4 vans.] [(2x76 miles) ÷ 15 mpg x $.93/gallon x 4 vans = Total.]
Total cost for campsite.	$120 [38 people ÷ 8 people/campsite = 5 campsites] [$12/night x 2 nights x 5 campsites]
Total cost for the trip.	$670.70
Total amount for each student to raise	$20.96 [Total cost for trip ÷ 32 students]

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GOING CAMPING
DATA ORGANIZATION SHEET
Teacher Answer Sheet

PEOPLE GOING:
Number of Students 32
Number of Adults 6
TOTAL PEOPLE 38

MEALS:
Number of meals per person 6
Number of people 38
Total meals served 228
Cost per meal $2.25
Total food cost $513.00

VAN COST:
Total miles (round trip) 152
Miles per gallon 15
Total gallons 10.133
Cost per gallon $.93
Number of vans 4 Individual van cost (gas) $9.42
Total van cost (gas) $37.70
(rounded to nearest dime)

CAMPSITES:
Number of people 38
Number of people allowed
Per campsite 8
Number of campsites needed 5
Number of nights 2
Cost of a campsite per night $12.00
Total campsite cost $120.00

Total cost of food, transportation, and campground $670.70

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GOING CAMPING
Student Activity Sheet 2
Teacher Answer Sheet

Situation:

The students decided to sell pencils and erasers with the school name on them to raise money for the camping trip.

Pencils cost $.05 each and erasers cost $.07 each. They plan to sell pencils for $.15 each and erasers for $.20 each.

How many pencils and erasers must be sold to raise the money necessary to go on the camping trip?

Total cost of trip from Activity Sheet 1 $670.70

Cost of 1 pencil $.05

Selling price of 1 pencil $.15

Profit on the sale of 1 pencil $.10

Cost of 1 eraser $.07

Selling price of 1 eraser $.20

Profit on the sale of 1 eraser $.13

To help you compete this Student Activity Sheet you need to first complete the Guess and Check Sheet.

Approximate number of pencils to be sold to meet goal

Profit on the sale of pencils

Approximate number of erasers to be sold to meet goal

Profit on the sale of erasers

Answer will vary according to discussion in the process of working through the Guess and Checks Sheet.

TOTAL PROFIT

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Names_____ _____ _____ _____

GOING CAMPING
Student Activity Sheet 1

Planners: _____ _____ _____ _____

Situation:

The students in room 18 want to go on a class camping trip.

There are 32 students in the class. Food will cost $2.25 per meal for each person. Students will bring their own clothes and a sleeping bag. The camping equipment will be borrowed from the students' families. School vans will be used to get to the campsite. The van holds 12 people and gets 15 miles per gallon. The school district will provide vans for free that normally rent for $60.00 per day. The campsite is 76 miles from the school. Gasoline costs $.93 a gallon.

Campsites cost $12.00 per night and each campsite will hold 8 people. The principal says there should be 1 adult for every 6 students. The camping trip will last from 5:00 p.m. Friday night to 4:00 p.m. Sunday afternoon.

The students must raise the money for gas, food, and the campsites for everyone involved.

How much money must be raised for each student to go on the camping trip? What is the total cost? Use Data Organization Sheet to complete information below.

Total cost for food. _____

Total cost for vans._____

Total cost for campsite._____

Total cost for the trip._____

Total amount for each student to raise._____

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GOING CAMPING
DATA ORGANIZATION SHEET

PEOPLE GOING: Number ofStudents _____

Number of Adults _____

TOTAL PEOPLE _____

MEALS:

Number of meals per person _____

Number of people _____

Total meals served _____

Cost per meal _____

Total food cost _____

VAN COST:

Total miles (round trip) _____

Miles per gallon _____

Total gallons _____

Cost per gallon _____

Number of vans _____ Individual van cost (gas) _____

Total van cost (gas) _____
(rounded to nearest dime)

CAMPSITES:

Number of people _____

Number of people allowed

Per campsite _____

Number of campsites needed _____

Number of nights _____

Cost of a campsite per night _____

Total campsite cost _____

Total cost of food, transportation, and campground _____

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Names_____ _____ _____ _____

GOING CAMPING
Student Activity Sheet 2

Situation:

The students decided to sell pencils and erasers with the school name on them to raise money for the campling trip.

Pencils cost $.05 each and erasers cost $.07 each. They plan to sell pencils for $.15 each and erasers for $.20 each.

How many pencils and erasers must be sold to raise the money necessary to go on the camping trip?

Total cost of trip from Student Activity Sheet 1 _____

Cost of 1 pencil _____

Selling price of 1 pencil _____

Profit on the sale of 1 pencil _____

Cost of 1 eraser _____

Selling price of 1 eraser _____

Profit on the sale of 1 eraser _____

To help you compete this Student Activity Sheet you need to first complete the Guess and Check Sheet.

Approximate number of pencils to be sold to meet goal _____

Profit on the sale of pencils _____

Approximate number of erasers to be sold to meet goal _____

Profit on the sale of erasers _____

Total profit _____

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Names_____ _____ _____ _____

GOING CAMPING
GUESS AND CHECK SHEET

Total cost of trip from Activity Sheet 1 $_____

Estimate the number of pencils and erasers you will need to sell in order to earn just enough money for the trip. Write the estimate in the chart and use your calculator to compute the profit. In order to arrive at the amount of profit, you may need to do several estimates. Use each result to get as close to your goal as you can to meet expenses.

Estimated pencils to be sold	Profit per pencil	Profit from pencil sales	Estimated # of erasers to be sold	Profit per eraser	Profit from eraser sales	Total Profit from pencils and erasers

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CHAPTER 4 ASSESSMENT

NUMBER AND ALGEBRA

1. How do you use a calculator to get a quotient with a whole number remainder? Write the steps used to find the quotient with a whole number remainder in simple language so that a young child would understand.

   Student response.

   To use a calculator to find remainders in division of whole number problems:

   1. Divide using the calculator.
   2. Write down the whole number part of your answer. (Leave off the decimal part.)
   3. Multiply the whole number part of your quotient by the divisor.
   4. Subtract this result from the dividend.
   5. The result should be your remainder.

   $26\overline{)837}$

   837 ÷ 26 shows 32.192307 on the calculator. Record the 32. Multiply 32 x 26 = 832. Subtract 832 from 837. 837 - 832 = 5. So $26\overline{)837}$ = 32 R5.

2. Write a situation where you would use division with whole number remainders.

   Student response will vary.

3. Use an encyclopedia, Guinness Book of World Records, or an Almanac to find interesting facts about animals sizes. Write and solve some mathematical questions using the facts you have researched.

   Student response will vary.

4. Estimate, then solve.
   a. How many years are there in 1,000,000 days?
   b. How many years are there in 1,000,000 hours?
   c. How many years are there in 1,000,000 minutes?

   Student responses:
   a. 1,000,000 days ÷ 2739.726 = 2739 complete years ÷ 265 days
   b. 1,000,000 hours ÷ 24 ÷ 365 = 114.15524 = 114 years
   c. 1,000,000 minutes ÷ 60 ÷ 24 ÷ 365 = 1.9 years (about 2 years)

5. How long will it take you to read a million words? Make an estimate. Determine a strategy and carry out your plan to solve the problem. Interpret your results and write alternate ways in which this answer can be found.

   Student response will vary. All responses should mention obtaining data for a smaller number of words.

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6. Write the rule for multiplication of decimals. Include examples.

   Student response will vary. Responses may refer to the number of decimal places in the factors and product. Alternate explanations involving fraction are also to be expected.

7. Multiply 1234.5678 by 1000 and divide 1234.5678 by 1000. Explain how you arrived at your answer.

   Student responses:
   1234.5678 x 1000 = 1234567.8
   1234.5678 ÷ 1000 = 1.2345678

8. The total price of a package of hamburger is $10.27. The number of pounds and the price per pound on the label is smudged. Complete three possible labels that include weight and price per pound.

   Student response will vary. In all cases the number of pounds multiplied by the price per pound must round to $10.27. The "reasonableness" of answers needs to also be discussed.

9. Sparkling apple juice comes in three different sizes: 12, 32, and 48 fluid ounces. Today the market showed them priced as follows: 12 oz for $.55, 32 oz for $1.29, and 48 oz for $1.69. Which is the best size to buy? Explain.

   $.55 ÷ 12 oz = .0458333
   $1.29 ÷ 32 oz = .0403125
   $1.69 ÷ 48 oz = .0352083

   The 48 oz package is the least expensive per ounce. The best to buy may also take into account the size of the package and how often you drink apple juice.

10. Research how much it would cost to make cupcakes for 100 students. List the ingredients needed. Include the cost of the cupcake papers and all other necessary items.

    Student response will vary.

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11. Which would you rather have, $5,000 or a magic dime that doubles every day for 27 days? Why is it the better choice? How much more money would you have?

Student response: Magic Dime

Day	Amount of Money
1	.10
2	.20
3	.40
4	.80
5	1.60
6	3.20
7	6.40
8	12.80
9	25.60
10	51.20
11	102.40
12	204.80
13	409.60
14	819.20

Day	Amount of Money
15	1638.40
16	3276.80
17	6553.60
18	13107.20
19	26214.40
20	52428.80
21	104857.60
22	209715.20
23	419430.40
24	838860.80
25	1677721.60
26	3355443.20
27	6710886.40

From the 17th day on, the amount of money from the magic dime is more than $5000. On the 27th day you have $6710886.40, that is $6705886.40 more than $5,000.

12. Use your calculator to change the following fractions to decimals to determine which are equal.

a. $\frac{29}{464}$ b. $\frac{114}{399}$ c. $\frac{17}{272}$

d. $\frac{28}{63}$ e. $\frac{106}{371}$

Student responses:

a. $\frac{29}{464} = .0625$ b. $\frac{114}{399} = .2857142...$ c. $\frac{17}{272} = .0625$

d. $\frac{28}{63} = .44444...$ e. $\frac{106}{371} = .2857142...$

$\frac{114}{399} = \frac{106}{371}$ and $\frac{29}{464} = \frac{17}{272}$

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13. Fill in the missing digit or operation symbol to make these equations true.

14 [ ] .5 + 78 = 223.5
26.4614 [ ] 8.2 = 3.227
173 x 8 [ ] 4 = 1388

Student responses:

14 [5] .5 + 78 = 223.5
26.4614 [+] 8.2 = 3.227
173 x 8 [+] 4 = 1388

14. Explain why an order of doing operations is necessary. Demonstrate, using at least two examples.

Student responses will vary. All responses should refer to the fact that many expressions would have several different answers if there was not an order for doing operations.

15. Place parentheses to make this sentence true: 23 x 39 + 50 x 73 = 149,431

Student response.
23 x (39 + 50) x 73 = 149,431

16. Write the order of operations.

Student response.
Parentheses (left to right)
Exponents (left to right)
Multiplication and division (left to right)
Addition and subtraction (left to right)

17. By placing parentheses, see how many different solutions you can obtain for 15 + 12 x 16 + 24 - 8. Show your work.

Student responses could include:
(15 + 12) x 16 + 24 - 8 = 448
15 + (12 x 16) + 24 - 8 = 223
15 + 12 x (16 + 24) - 8 = 487
15 + 12 x (16 + 24 - 8) = 399
(15 + 12) x (16 + 24) - 8 = 1072
(15 + 12) x (16 + 24 - 8) = 864

18. Write how to find the least common multiple of 11 and 13 using two calculators.

Student responses.
Use one calculator to show multiples of 11 and the other to show multiples of 13. The calculator with the smallest number in its display increases to the next multiple of its number until the numbers in both calculators match. The L.C.M. is 143.

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19. The local bank pays 8% interest each year on money in a time account. If you deposited $200 and leave it in your account for 12 years, how much money will your account be worth. (Interest is added to your account at the end of each year.)

    Student response.
    [(8 ÷ 100) + 100] x 200 = = = = = = = = = = = = = $503.63

20. A television set is on sale for 23% off at Store A. The regular price is $410. The same television set is on sale for 35% off at store B. There its regular price is $430. Explain which is a better buy.

    Student response.
    Store A $94.30 off. 410 - 94.30 = $315.70 sale price.
    Store B $150.50 off. 430 - 150.50 = $279.50 sale price.
    Store B is a better buy.

21. Describe and explain how you would plan a picnic for your class including all costs, such as: food, drink, transportation, and prizes. The teachers and adult guests need to be included in the costs, but are not expected to pay. Research costs of the picnic, then compute what you would charge each member of the class.

    Student responses will vary.

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